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ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with each copy of this week's issue.

High Speed Vindicated

RAILWAY speed has become a frequent subject of debate in the correspondence columns of newspapers, and new achievements often set on foot a controversy between those who welcome and those who deplore the portents of faster travel. The critics may be divided into two camps: there is the party that shudders at what it calls "the ever accelerating tempo of modern life"; and there is that which sees in high speed schedules a source of discomfort and a menace to the observance of punctuality. We do not think that the first class will find many sympathisers, for even minutes saved by faster journeys commend themselves to most of us as providing opportunities for better time spending. The other party has a larger following, for arguments alleging impaired comfort and convenience are always powerful. A correspondent in *The Times* has recently answered them in the one way possible, which is, unfortunately, so simple that it may not yet command universal belief. It is that modern properly maintained rolling stock rides just as smoothly at 85 or 90 m.p.h. as at lower speeds, while fast schedules are more strictly observed than those which neither gratify the traveller nor challenge the capabilities of the staff.

A Railway Saleswoman

It might at first be thought that the announcement—recorded in our personal columns this week—that the Great Western Railway has appointed Miss Audrey Shirtliff as its first railway saleswoman was an indication that there had been a sudden enlightenment in railway circles concerning the place of women in commerce. As a matter of fact, ever since the war the railway companies have been well to the fore in their attitude towards the employment of women, and special departments have been established to supervise the working conditions and even recreations of women employees. This itself has led in the case of the L.M.S.R. to the appointment of a woman to the responsible position of Welfare Assistant for Women and Girls. Along with other progressive employers, moreover, the railways have given special consideration to the nature of work for which female labour is utilised. Miss Shirtliff's appointment, even although it may open up a new sphere of activity for women, is fully in accordance with established policy. Time, no doubt, will show that there are other tasks peculiarly suited to women's talents. Already, for instance, in Australia, the Victorian Railways Department has appointed a woman as dietitian whose specialised knowledge and advice is being directed to the selection of female staff and in the scientific supervision and management of the Refreshment Services Branch of the railways. Miss Oxenford, Assistant Controller of the L.M.S.R. Hotel Services, also holds a similarly responsible position.

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The Week's Traffics

For the past week the four group companies show a total traffic gain of £110,000, comparing with an increase of £229,000 for the previous week. The Southern has improved its percentage increase for the year to date from 1·47 to 1·53 and the L.N.E.R. from 3·41 to 3·43, but the two other companies show no change in this respect. For the 37 weeks of the current year the traffics of the four companies amount to £111,185,000 an increase of £3,458,000, or 3·21 per cent. In merchandise the L.M.S.R. has an advance of £975,000, or 5·95 per cent., the L.N.E.R. one of £466,000, or 4·11 per cent., and the Great Western one of £286,000, or 4.30 per cent. Coal traffic increases are £429,000, or 5·14 per cent., on the L.M.S.R., £419,000, or 5·20 per cent., on the L.N.E.R., and £58,000, or 5·38 per cent., on the Southern.

	37th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 16,000	+ 26,000	+ 5,000	+ 47,000	+ 1,715,000	+ 3·96
L.N.E.R. ..	+ 15,000	+ 17,000	+ 3,000	+ 35,000	+ 1,079,000	+ 3·43
G.W.R. ..	+ 6,000	+ 3,000	+ 4,000	+ 13,000	+ 437,000	+ 2·41
S.R. ..	+ 14,000	+ 1,500	− 500	+ 15,000	+ 227,000	+ 1·53

London Transport receipts for the past week amounted to £558,200, an increase of £13,800.

* * * *

Railway Literature

Railway notices rarely rise above a bald imperative, and even such metrical adventures as "to stop the train pull down the chain" strike the average reader as lacking in the finer shades of poetic technique. The aspersions likely to be cast in consequence upon the cultural background of the railway industry will, however, have been countered by the polished irony of a notice lately displayed in trains of the London Passenger Transport Board. It read: "these doors are provided for passengers wishing to step in or out. They can only be used if other passengers will please stand clear." In view of this appeal, before which, alas, the great unlettered public stood brutishly unmoved, it seems to us a pity that the accelerated tempo of London life has rendered unfashion-

able the sedate but obstructive form of locomotion that inspired "do not sit on the stairs." We should enjoy reading a revised version on lines such as these: "the escalator is to be admired for its utility rather than as a provider of cheap sensation, and passengers using it in the manner for which it is intended will find that they will extend appreciably the life of a part of their apparel which delicacy forbids us to define."

* * * *

Sierra Leone Railway

For the year 1935 the surplus of earnings over ordinary working expenditure gave a return of 4·89 per cent. on the interest bearing capital, as compared with 1·92 per cent. in 1934. As indicated in the accompanying table the operating ratio was lowered by 15·13 per cent., due principally to the increased revenue earned with a small decrease in expenditure. Coaching revenue improved by £2,103 and goods revenue by £19,555, apart from the increase of £6,884 in the subsidy in respect of the reduced freight on palm kernels, of which a record tonnage was carried. The main source of the increased goods revenue was the traffic in imported goods railed from Freetown for mining construction work and the replenishment of merchants' stocks.

	1935	1934
Passengers	450,707	377,123
Public goods, tons	71,628	59,938
Train-miles	373,422	339,088
Operating ratio, per cent. ..	71·59	86·72
	£	£
Gross receipts	180,005	151,214
Working expenditure	128,861	131,138
Loan charges and sinking fund	57,693	59,381
Net deficit	6,549	39,305

Running lines in operation consisted of the main line (Freetown—Pendembu) of 227¼ miles, and the Bauya-Makeni branch of 82¾ miles.

* * * *

Standardised Offices

The decision of the railway companies to hold a competition for a standardised front and interior for their seventy-one several offices in London is a wise one. True, many of these offices are even now easily distinguishable by the air of melancholy that pervades their display, suggestive of the last despairing effort of a failing bookseller, but no doubt the new front and interior will tend to make things more cheerful. It will not be an easy task for the competing artists to evolve a design that will fit frontages of varying sizes, indeed the solution of the problem would seem to lie in a Procrustean fascia and an outstretching sign. Signs, in themselves, are interesting because they carry on old traditions, but our streets are so cluttered up with hanging signs of all sizes, shapes, and dispositions—not to mention beacons, traffic light posts, telephone kiosks, and lamp-posts—that it is difficult to discover a particular sign at a distance. If the winning design of office front prove to include a sign, it is to be hoped that the emblem will bear some relation to facts; if a locomotive be included it should appear to be efficient and practical; advancing design will make it look strange in a very few years, but that is not a reason for making it unconvincing now.

* * * *

Three Years' Outlay on Air-conditioning

The importance attached to air-conditioning by the American railways is evident from the present intensive investigation of different systems and public reactions to their effects, referred to editorially in our issue of August 28. No less striking testimony to the thoroughness with which air-conditioning possibilities are being explored is the fact that between 1932 and 1935 the railways spent fifty million dollars on equipment and its maintenance for about six thousand passenger vehicles. These figures have been quoted by Mr. L. W. Wallace, Director of Equipment Research, Association of American Railroads, in the course of a recent address. He considered that there had probably been no procedure adopted by the railway industry of greater importance than air-conditioning. It was safe to predict that the improvements still to be realised would add to public appreciation of the cleanliness and comfort of railway travel, and contribute materially to an increase in passenger traffic. The air-conditioning questionnaires which travellers are now being invited to answer will no doubt assist towards this result by establishing a stronger sense of common interest between the railways and their patrons.

* * * *

The Boardwalk Flyer

One of the most interesting of American train accelerations this summer is, in effect, no more than a reversion to a time which operated thirty years ago and more between the same points. The Boardwalk Flyer, at that time the crack train of the Philadelphia & Reading Railroad between the Camden station at Philadelphia and Atlantic City, bridging the distance between city and coast in the even hour, is the train concerned. As the first stage across the Delaware River to Camden terminal had to be made by ferry, taking at least ten minutes, it was left to the train to cover the remaining 55·5 miles to Atlantic City in 50 min., at a start-to-stop average of 66·6 m.p.h. Further, as the ferrying frequently took longer than the time allowed, it was left to the express to make up the arrears, which almost invariably it succeeded in doing; the culmination of this time recovery was probably the record run of May, 1905, when the journey was completed with a 280-ton train in 42 min. 33 sec., at a start-to-stop speed of 78·3 m.p.h. Today the conditions are totally different. The Boardwalk Flyer comes under the joint operation of the Pennsylvania and Reading Companies, and follows the joint route via Haddonfield, 57·9 miles in length as compared with 55·5 miles. Only 8 min. are allowed for the ferrying, leaving 52 min. for the train, if the ferry is punctual. But this average speed of 66·8 m.p.h. must now be maintained with a train of between 600 and 700 tons in weight.

* * * *

A Buffet Car de Luxe

Light meals quickly and deftly served under the most comfortable seating conditions, or, alternatively, a snack and a drink standing at the bar, afford amenities intended to relieve railway journeys of the tedium of which many passengers are apt to complain. The dining car, with its more elaborate set meals, caters for conditions that are different, and there is no sort of comparison between it and the buffet type of vehicle except that each provides a very distinct want, identical in purpose but varying in degree. The new L.M.S.R. buffet cars, of which an illustrated description appears on pages 455-458 of this issue, have been carefully and skilfully designed to give the kind of service required by passengers—often of the excursion class—who prefer something light and refreshing at a lower cost and under conditions of a perhaps more free and easy kind than those of the other vehicle. The airiness, clean-looking and highly attractive "cafe de luxe" interior, and special methods taken to ensure comfortable atmospheric conditions and ample window spacing, will, it is certain, combine to make these new vehicles, when they have become better known, much sought after by the travelling public. We were enabled to make an inspection of one of the cars, in its finished state, in the

Derby works of the L.M.S.R., and to see others in course of construction there. We were much impressed with the excellence of design and workmanship displayed, and we think it a happy idea to have indicated the Empire woods used for the interior panelling by means of very neat and unobtrusive ivorine labels. The fabrication of the entire side and end steel panels by welding is a feature which displays very clearly the strides that have been made in the process as applied to rolling stock.

* * * *

Level Crossings in Illinois

The numerous level crossings on the railways of the United States still give rise to many accidents, although in recent years rapid strides have been made in some districts with the provision of adequate warning signal apparatus. Such apparatus often necessitates special study, because the railways sometimes cross a succession of streets in a town, and it is important that shunting moves, for example, shall not restrict road traffic unnecessarily. According to *Railway Signaling*, the State of Illinois, among others, intends to spend $500,000 on warning signals at 264 crossings, and improved reflector signs at 420 more. Excluding city streets there are 97,614 miles of roads in the State and 18,031 level crossings, and of these only 3,546 had till recently any other protection than warning signboards; some had gates or watchmen and 2,210 had automatic signals, such as lights and bells. Mr. Warren Henry, of the Illinois Commerce Commission, devised a formula for calculating the approximate risk at each crossing, based on local conditions, user, &c., and from this a programme of work has been drawn up, the money being obtained by the State under the Second National Recovery Administration Act. The laws of Illinois have recently been amended so as to give level crossing signals the force of traffic lights and make it obligatory to obey them, while systematic observation is being kept to detect the causes of accidents.

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Locomotive Contracting in America

Apropos of the points discussed in the article on "Locomotive Building" on page 409 of last week's issue, in which the views of Lt.-Col. E. Kitson Clark were set forth, it is of interest to note what a correspondent, Mr. Roland E. Collins of Chicago, has to say as to the practice followed in the U.S.A. when placing contracts for new locomotives. Generally speaking, he remarks, the American railways do not build their own locomotives; they repair and *rebuild* them from the boiler tubes up, but only two or three companies make a practice of turning out new engines in their own shops. While there are other explanations in some cases, it is generally true that the shop facilities of most American railways are seldom adaptable for anything more than repair work, and are not equipped to carry on a manufacturing industry of any size. When these railways need new engines they need them in a hurry and in quantities. Their track standards and bridge-loading limitations will have improved considerably in the years since the last new engines were put into service, and a very material increase in wheel loads will be possible. The directors appropriate say five million dollars (nearly £1,000,000) for the purpose, and the motive power officers will go to all of the three large locomotive builders and say "we need 50 new engines before August. Here are our limits on total weight, axle loads, height and side clearances, and it will have to turn on an 84-ft. turntable. Let's see what you can do it for; we'll be back on Monday at 10 o'clock to look at your designs." By Tuesday night a likely looking design has been selected and a price agreed upon, and the orders will go into production on Wednesday morning. "The result," says our correspondent, "is just what was to be expected; 50 of the finest locomotives money can buy, carrying all the latest improvements and performing with an efficiency and economy of fuel, water and lubrication which utterly astonishes all concerned, including the enginemen who have been nursing the old engines for a decade."

* * * *

A Railway that Carries Tramcars

The local transport system of Cincinnati, Ohio, includes a remarkable feature in the Mount Adams incline railway, which has recently been completely renovated, and resumed working on June 9 last after a stoppage of three weeks for repairs. This incline railway, which began service in 1877, is the property of the Cincinnati Street Railway and carries the ordinary tramcars on conveyor trucks up a 28·9 per cent. gradient 980 ft. long, resulting in a vertical lift of 261 ft. There are, of course, many cable-operated incline railways in various parts of the world, but the Mount Adams railway claims to be the only one now in service to carry tramcars bodily. On this line, which is double track, the 35-ton conveyor trucks are joined by a $1\frac{3}{8}$ in. cable which serves the combined purposes of acting as a safety cable and also balancing the load. Each truck is moved by two 1,200 ft. traction cables, $1\frac{1}{4}$ in. in diameter, consisting of 114 strands of steel wire wound round a $\frac{1}{2}$-in. hemp cord. The four traction cables have an individual breaking strain of 67 tons. Two Corliss high-pressure engines drive separate 14-ft. drums, one to each track, giving the cables (and hence the incline cars) a speed of 650 ft. a minute. Nearly two million passengers per annum use the incline, many for the novelty, and this was a deciding factor in justifying the rehabilitation of the line, rather than replacing it by a bus service on an alternative route.

* * * *

Types of U.S.A. Motive Power

It is not necessary to quote elaborate statistical data in order to prove that the bulk of the traffic on U.S.A. railroads is handled by steam locomotives. Of course, the main reason is that, as the existing steam locomotives have been built to last a long time, say 15 to 25 years, they are still doing useful work. Fifty thousand steam locomotives could not be put on idle tracks, or scrapped, even if a better machine were developed. Nevertheless, the increasing use of both electric and diesel motive power during the past few years, has received an extensive publicity that may have resulted in popular misconception as to the relative proportions of the newer forms of traction. Considerable interest therefore attaches to some figures given by Mr. A. I. Lipetz, Chief Consulting Engineer of the American Locomotive Company, in a paper he presented recently to the Metropolitan Power Plants Committee, New York. He said that, during the six years of depression, 1930-1935, 1,149 locomotives were built in his country, of which 979 were for use in the United States. The latter number was divided among various kinds of power in the following way: steam, 623 (63·7 per cent.); electric 252 (25·8 per cent.); and diesel-electric 104 (10·5 per cent.). The total of electric locomotives included the 150 locomotives of the outstanding electrification scheme of the Pennsylvania Railroad. Mr. Lipetz added that as soon as business showed signs of improvement, steam locomotives again began to play a large part in the allotted orders, and during the first two months of 1936 alone, American locomotive builders received orders for 42 steam locomotives; no electric locomotives were ordered, but an order for 1 diesel-electric was placed. Steam locomotive builders were now more busy, he added, than at any time since 1931.

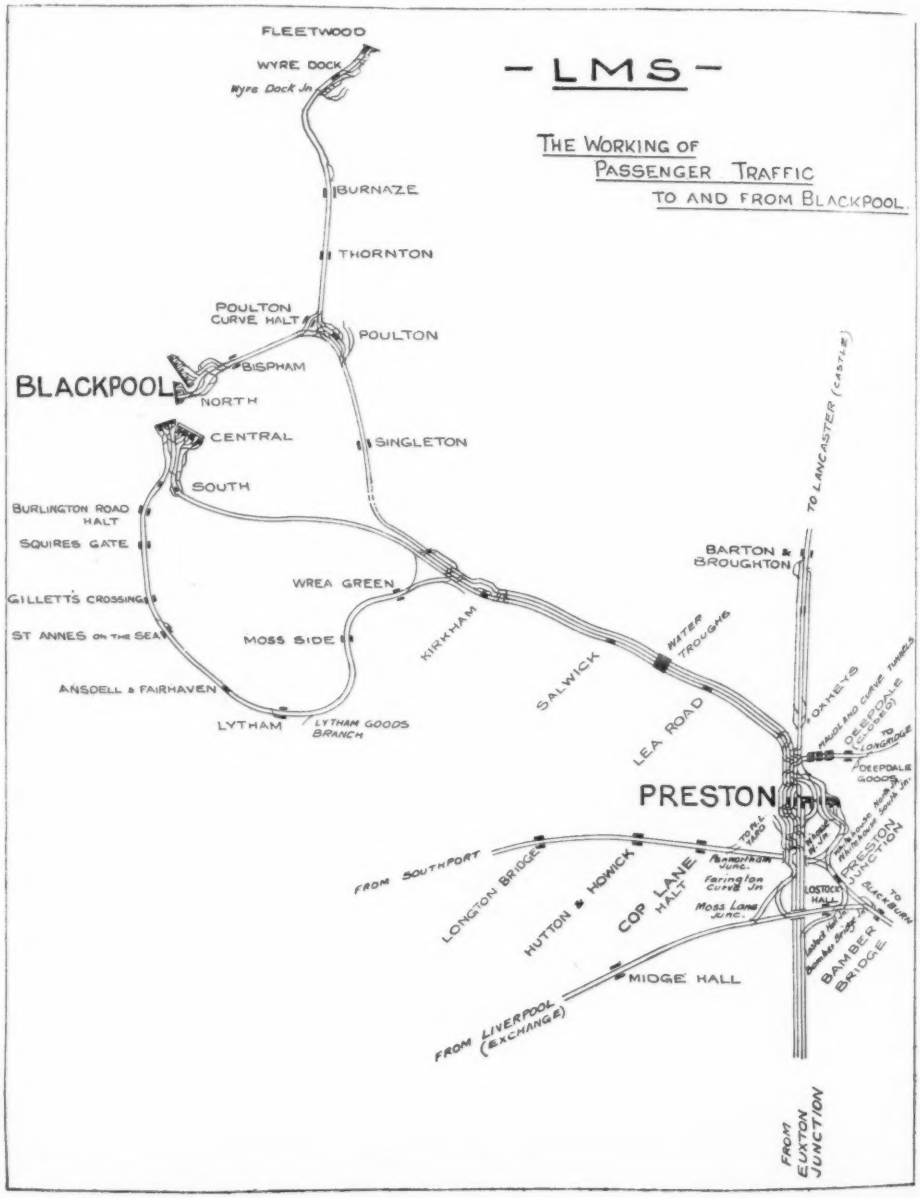
XUM

The "How" of Blackpool

DURING the last week scientists have been fascinating themselves and others by examining and analysing Blackpool in much the same way as they would some unknown substance in a test tube. As a result the "why" of Blackpool has been explained in a multitude of different theories. The "how," on the other hand, without which there could be no "why," has been left to one man to expound. In a paper before the Engineering Section of the British Association, Mr. Ashton Davies, Chief Commercial Manager, L.M.S.R., explained the extraordinarily highly developed railway transport system that had been devised to bring the multitudes from industrial Lancashire and Yorkshire to the pleasure beaches of the Fylde coast. Without the facilities provided by the L.M.S.R. there would probably have been no "big dipper" for members of the British Association to discover as possessing "the fear-escape propensity," or the crowded beach to point to as a practical demonstration of the "gregarious impulse," for it is the railway which brings the large majority of the pleasure seekers to Blackpool. Each Saturday in August, for instance, as many as 100,000 persons are taken into Blackpool by rail and an equal number leave the resort. The problem of dealing with these crowds, however, may be underestimated unless it is realised that a very large proportion of the visitors are only day or half-day excursionists who arrive together as early as possible and leave together as late as possible, and thus intensify the difficulties of a peak day with very marked peak hours.

To meet these exigencies a local control is brought into operation. This extends to Preston, through which all the traffic for Blackpool must pass. From the route diagram (reproduced), with which Mr. Ashton Davies illustrated his paper, it will be seen that from Preston there are two up and down lines as far as Kirkham. At Kirkham these diverge into three separate sets of double track, one direct for fast trains to Blackpool Central, another via Lytham to Blackpool Central, and a third via Poulton to Blackpool North, and Fleetwood. The problem is to ensure continuous movement of traffic over these lines. To meet this Mr. Ashton Davies explained that although normally a block section between two signal boxes can contain only one passenger train on each line, the introduction of intermediate signals, together with track circuiting, has made it possible to have with perfect safety one train passing a point beyond a signal box while another is approaching on the same line from the box in the rear. The scheme involves 46 signal boxes, and enables 14 or more trains to move simultaneously in the up, and 10 in the down direction. Thus it is sometimes possible that more than 30 trains to or from Blackpool may pass Kirkham in an hour, and this rate of flow may at times be maintained for two or three hours at a stretch.

These signalling arrangements pre-suppose, of course, adequate terminal facilities at Blackpool. Blackpool Central station has 14 platforms, with a total length of 8,888 ft., and Blackpool North has 16 platforms with a total length of 9,900 ft. Between them these two stations may have to cope with nearly 500 trains in the course of



a single day. To ease such a situation every endeavour is made to keep ordinary and excursion trains separate. Loud speaker installations are freely used for the direction of passengers, and the station staffs are frequently augmented by those from lower grades. Most important, however, in the control of Blackpool traffic, is the travel regulation scheme, introduced in 1918, under which at peak periods the issue of tickets to Blackpool is controlled by a Ticket Regulation Department in Manchester. From this office stations are authorised to issue a stated number of tickets for each regulated train, such allocation being based on previous years' issues and in relation to the seating capacity of the train. Any unexpected variations in bookings are, by means of daily returns, brought to the notice of the Regulation Department, which can then make any necessary adjustments in the distribution of tickets. Any tickets issued for journeys on regulated days bear the schedule number of the train, thus simplifying the handling of crowds at stations. An article describing in detail the regulation of Blackpool traffic appeared in THE RAILWAY GAZETTE for July 2, 1920. As a guide to the whole task of dealing with these huge incursions there is the weekly special train programme worked out in conjunction with the local station officials. Even these carefully prepared timetables are, however, as Mr. Ashton Davies points out, liable to be upset not only by weather but by an increase in the spending margins of the people, or even an under-estimation of the increasing popularity of Blackpool. In a single year the Blackpool district stations have to cater for nearly 6,000,000 passengers, excluding season ticket holders, and so rapidly is this traffic increasing that the 1935 figures show a 43 per cent. increase over those for 1931.

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Mr. Stanier on Testing of Locomotives

IN the address which he gave at the annual meeting of the British Association at Blackpool on Friday last, September 11, Mr. W. A. Stanier, Chief Mechanical Engineer, L.M.S.R., took as his subject "The Development and Testing of Locomotives." He pointed out that until comparatively recently the facilities for testing locomotives in service have been of a very simple character, and it has been difficult to get reliable data on the working of the engine and the boiler, as well as the numerous accessories which are developed and offered for trial each year. It is, moreover, somewhat difficult to arrange a series of tests on the running lines without causing inconvenience to the working of the railway. Such work as is done is usually carried out on an ordinary booked train, but occasionally it is possible to arrange a special trial on a Sunday when the line is less occupied with regular train service. As a result of this it has not been possible until within recent years for the locomotive engineer to set out a predetermined programme of trials, such as would possibly have led in the infancy of locomotive design to a much more rapid development, comparable with that of the internal combustion engine. Mr. Stanier recalled that probably the first vehicle used for experimental work on the English railways was a broad gauge four-wheeled van which about the year 1879 was converted to narrow gauge and fitted up as a measuring van on the Great Western Railway. It had a fifth wheel which could be raised and lowered with suitable mechanism, and which operated a series of counters indicating the distance travelled in miles and fractions of a mile. The introduction of this car is generally attributed to Sir Daniel Gooch, and the dynamometer spring and a recording mechanism with paper drive were added.

The development of the dynamometer car has put into the hands of locomotive engineers a means of investigating engine performance while working trains, and it is of great assistance to have available so quickly such particulars as average and maximum drawbar-pull, coal and water per ton-mile and per drawbar h.p., the results obtainable at the end of each dynamometer car test, making it possible to carry out accurate investigations. The old method of quoting coal consumption for locomotive performance was on the basis of lb. of coal consumed per ton-mile, and owing to the varying climatic conditions, loading, &c., it was necessary for extensive tests to be carried out in order to obtain a representative average figure. Since the advent of the dynamometer car, however, it has been possible to obtain quite accurate coal consumption figures, on the basis of the actual work performed *i.e.*, lb. of coal per drawbar h.p. hr., and due to the fact that this coal consumption is based on the actual output performance of the locomotive, it is necessary to make only a comparatively few runs to obtain the information required. With the high-pressure boilers now in service, a large number of which are working at 225 lb. and others at 250 lb. pressure, it is very necessary to have the most efficient steam distribution to ensure economical working, and by fitting the locomotive with suitable indicating gear, indicator cards can be obtained which provide analysis of the steam distribution. A very thorough investigation can be quickly carried out to ascertain whether the engine motion is really functioning to give the most economical results.

A large part of Mr. Stanier's address was devoted to descriptions of apparatus and tests, and the methods followed in conducting the tests. Among the most interesting investigations described was one made with a 4-6-0 express engine of the L.M.S.R. to discover the effect of worn parts on the economical working of a locomotive. This comprised a series of dynamometer car tests at different periods of the life of the engine, *i.e.*, just before and just after piston, valve and service repairs. From the results obtained during these tests, the efficiency of the engine and boiler was seen to deteriorate at a very slow rate, and it was found that the maximum increase in coal consumption per drawbar h.p. hr. was about 8 per cent. higher than when new. The boiler efficiency showed very little depreciation, although the steaming properties were not so good when getting towards the time of the next general repair.

Brake tests, and the stopping distances for trains at varying speeds, provide information of importance in railway operating, by showing the best position for placing the signals so that the enginemen shall have sufficient time to obtain complete control of the train, and be able to stop at the home signal. It is necessary to take into account the stopping distances of trains of varying weights and at different speeds. With the gradual increase in the weights and lengths of trains, this factor is of the utmost importance, and a lantern slide was shown illustrating various combinations of locomotives and passenger trains, and the stopping distances for the trains over a range of gradually increasing speeds up to 95 m.p.h. In addition to the dynamometer car, each train was provided with vacuum recorders at the front, middle and rear of the train, so that the rate of propagation of the brake down the train could be analysed. In concluding, Mr. Stanier drew attention to what is probably one of the most important decisions that had to be made on the amalgamation of the constituent railways of the L.M.S.R. in January, 1923, namely, that of deciding on the types of locomotives which should be adopted as standard, and conversely which of the older and less economical types should be scrapped and this was an investigation in which the dynamometer car played an important part. To meet

the requirements of the operating department, more modern types have been built as and when necessary, and at the end of 1937, as a result of the continuation of this policy, the reduction in total steam locomotive stock will, it is estimated, amount to 27 per cent., and the reduction of types to 63 per cent.

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Transport of Food

THE distribution of food supplies by railway throughout Great Britain was the subject of an address by Sir Harold Hartley, Vice-President, L.M.S.R., to the Society of Chemical Industry in 1935, and his paper was published in our issues of July 26 to August 16 inclusive last year. At the British Association meeting in Blackpool which closed on Wednesday, food transport has again been dealt with, this time by Mr. T. M. Herbert, M.A., A.M.Inst.Mech.E., Research Manager, L.M.S.R. Mr. Herbert spoke in particular from the scientific point of view, explaining the problems facing the chemist in connection with the transport of perishable foodstuffs, and his contribution, in co-operation with the physicist and the engineer, to the provision of an adequate national diet. Today, food transport in this country implies both the importation and the distribution of supplies, but Mr. Herbert showed that the business of importing food remained largely a luxury trade until the industrial revolution. Keeping pace with the demand for meat had become an urgent and difficult problem by 1870, at which time dried or salted meat was an article of international commerce, but refrigerated transport was in its infancy. An unsuccessful experiment in this direction had been made in 1860, after which the pressure of necessity led within the next twenty years to the development of various practical systems of refrigeration for shipboard. Chilled, as distinct from frozen meat transport, was not achieved for another forty years. Fruit transport under controlled conditions developed more slowly; it was taken in hand later, and it was not until 1900 that the most suitable temperatures were established. Now, however, the overseas trade in bananas is twice as important financially as that in beef.

To show the extent of our dependence upon overseas food supplies, and consequently upon the railways to distribute them from the ports, Mr. Herbert remarked, among other examples, that Great Britain imports nearly 80 per cent. of the wheat she needs, 90 per cent. of the butter, 50 per cent. of the beef and mutton, and all the citrous fruits and bananas. The country spends some £1,075 millions on food annually, but it has been stated that barely 50 per cent. of the population obtains a diet which is adequate for health. As demand for a more general distribution of perishable meat and fruit increases, so will the responsibility of the railways in catering for it, although it will in some measure be offset by the growing consumption of canned goods requiring no special precautions in transport. Limitations of space complicate the provision of refrigerating facilities in railway vehicles. Mechanical units involve an unfavourable weight-load distribution, and have not been adopted to any extent except in countries where high-capacity bogie wagons are in use. In this country much research is being carried on to ascertain the best means of using solid carbon dioxide as a refrigerant, which by reason of its convenience, lightness, and great refrigerating power, is particularly suitable for containers and small vans.

In outlining the transport requirements of the principal perishable foodstuffs, Mr. Herbert referred to the effect of accelerated freight services upon the conveyance of home-produced meat. There is a considerable volume of such traffic from Scotland to London, and the adequately ventilated vans in which it is conveyed, together with the effect of faster trains, makes the use of even a small quantity of refrigerant unnecessary under most normal conditions of temperature. Another important food traffic from Scotland to London is in kippers, where the problem is to avoid loss of oil content in warm weather. The long journey from the Kyle of Lochalsh is now made in insulated containers refrigerated with solid carbon-dioxide, whereby the kippers are prevented from reaching a limiting temperature of 45° F. The same temperature must not be exceeded for milk, and both ice and solid carbon-dioxide are used in milk vans. Increasing use is now being made, however, of 2,000-3,000 gal. tank wagons for bulk transport of the commodity, and these tanks can be insulated to avoid a rise in temperature exceeding three or four degrees Fahrenheit. The milk is cleaned, cooled, and pasteurised before loading. Similar methods are not applicable to cream, which has to be carried in rather small quantities. The individual churns have therefore to be refrigerated, and this is done with complete success by packing water ice around them. Alternatively, eutectic inserts (sodium and ammonium citrates in water) are fitted into the mouth of the can, and frozen before each journey. Such an insert will maintain a can of cream at 34° F. for sixteen hours—long enough for the journey to London from Northern Ireland.

* * * *

Factory Sites

A FEW years ago a well-known railway lecturer remarked at the London School of Economics that the negotiations conducted by the Great Western Railway which had resulted in such a large number of factories being established on its system in the neighbourhood of Slough, constituted one of the most successful examples of railway canvassing brought to his notice. However this may be, there is no doubt that the British railways generally realise to the full the desirability of encouraging manufacturers and traders to build or rent premises adjacent to their lines, and in recent years comprehensive efforts have been made to influence the establishment of factories with rail connections. In order to assist industrialists who desire to move their works or establish new ones, the companies maintain an up-to-date register of sites available for the building of factories, and of vacant factories which may be rented or purchased on or near their systems. With this information the railways are able constantly to assist manufacturers not only to find suitable sites, but also to obtain the most suitable accommodation for a particular industry. Detailed and authentic information is made readily available by the companies to manufacturers and traders regarding such important considerations as the nature of the soil, local charges for rates and taxes, the cost of gas, water and electricity supplies, the availability of labour, male and female, and the local rates of pay, accommodation for housing workpeople, the sources of supply of new materials, information regarding the potential markets for manufactured articles, methods for the disposal of effluent, &c.

Expert advice is also given as to the most advantageous and economic layout of private sidings and loading banks, and there is practically no limit to the amount of information on any aspect of the proposed development which the companies are ready to place at the disposal of traders. To assist concerns which find it necessary to move into other premises, the railway companies have built up a service which includes, if desired, the dismantling, conveyance and re-erection at the new works of the entire plant, including office equipment, and moves of this kind

can readily be performed in close co-operation with the manufacturer in order to ensure the least possible interference with production. These movements frequently necessitate the transfer of boilers, electrical equipment, and other articles of exceptional weight and dimensions, in which work the railways have specialised to a high degree. In addition to possessing suitable rolling stock for these heavy loads, the companies also maintain cartage equipment which enables them to undertake the collection and delivery of such loads by road, as well as the actual rail transport.

If the proposed factory is situated near a railway system, the company concerned is prepared upon reasonable terms and conditions to construct a private siding in connection with the works, provided that the physical conditions of the site permit and the potential volume of the traffic is sufficient to justify the necessary work. The construction of a private siding enables raw materials to be loaded direct from the supplier to the factory in through wagons, and unloaded at any point within the factory to suit the requirements of the business. In the reverse direction, manufactured goods or outwards traffic may be loaded in railway wagons and despatched to the various destinations without being touched by anyone except the sender's own staff. Special private siding rates are applied to such traffic from and to works, which enable an appreciable saving to be effected on the normal conveyance rates. The correct location of a factory is probably the most important consideration for the manufacturer, and the information and experience gained by the railway companies as a result of years of study of these problems have enabled them frequently to render valuable assistance to the development of trade and industry.

LETTERS TO THE EDITOR

(*The Editor is not responsible for the opinions of correspondents*)

Sir Daniel Gooch

London,
September 10

To the Editor of The Railway Gazette

Sir,—You are in error in crediting Sir Daniel Gooch with the bringing of Cleopatra's Needle to England (p. 427, September 11 issue). The transport was carried out by John Dixon, who built the Hammersmith bridge and was connected with early railway construction in China from 1861 to 1865; he ran the Bedlington Ironworks in conjunction with Mr. Mounsey. Cleopatra's Needle was brought to England in 1877 and erected on the Embankment in 1878. Dixon died at Croydon in 1891.

Yours, etc.,

EFFICIENCY

Sir Samuel Baker and the Kustenje Railway

Whitley Bay,
September 11

To the Editor of The Railway Gazette

Sir,—It is not generally known that Sir Samuel Baker, the African explorer, had anything to do with the making of railways. Nevertheless, this is so, and what is more, he took an active and important part in the construction of a European railway, and not as one might have expected, an African one. The subject has recently been recalled to my mind by Mr. S. H. Beaver's excellent article on the Bulgarian State Railways, and I send the following notes, which may be of some interest to your readers. To quote from "A Memoir" by T. Douglas Murray and A. Silva White, it was not until March, 1859, three years after his wife's death, at the age of 38, that Baker again engaged upon a serious undertaking. This was the construction of a railway connecting the Danube with the Black Sea, across the Dobruja. In a letter to Lord Wharncliffe, dated Kustenje, March 30, 1859, he writes:—

"When I left England I fully expected to have returned in the spring; but on arrival at Bucharest I found the railway company's contract for sleepers had not arrived; and, as no one was there to arrange matters, I took over the reins at once. I have now accepted the post as Manager-General of the company.

"I do not know whether you are aware of the proposed line of railway out here. It runs through Trajan's Wall, from Cernavoda (on the Danube) to Kustenje (on the Black Sea). The distance is only forty miles; but it saves the immense round viâ the Sulina [mouth of the Danube] and the dangers of that passage. We shall take the whole traffic of the Danube on our line, and ship it at Kustenje, where we are now constructing a port. . . ." It will be seen that he was somewhat optimistic as regards traffic on the railway!

A few days later Baker wrote to his sister:—

"We are progressing rapidly. The earthworks of the railway are advancing daily; the necessary buildings have been commenced, and, 1,200 workmen hard at it, give a new life to these barren shores, and much disturb the quiet rest of the ashes of Constanta, which we are excavating in forming our quays, and of the skulls and bones of heaps of dead. . . . My staff will soon be organised. My office is being built as fast as possible; and I am daily expecting the arrival of book-keepers and clerks. . . . I mean to make this a model concern, if I can, and to have all the arrangements in very perfect order."

This work consisted chiefly in organisation and supervision, for there were engineers to carry out the technical requirements of the undertaking. The railway was opened on October 4, 1860, and in spite of setbacks, has progressed. It is now a part of the main line from Bucharest, due to Constanza (formerly Kustenje) having developed into the chief port of Roumania, being the only one ice-free in winter. As well as the old harbour and station, there is now a large new harbour, and a new station in the town, and extensive sidings.

Yours, etc.,

J. GORDON PEIRSON

[The enterprise to which our correspondent refers was, of course, the Danube & Black Sea Railway and Kustenje Harbour Company, which was concessioned by the Ottoman Government and financed with British capital; the railway is now on Roumanian soil.—Ed. *R.G.*]

Southern Railway Upholstery

London,
September 7

To the Editor of The Railway Gazette

Sir,—The Southern Railway is to be congratulated on the pattern and shade of its latest third class upholstery. This green design is the first of many Southern Railway seat coverings which really deserves to be standardised. The old red and black plush was a legacy of the South Eastern & Chatham and exemplified Victorian lack of imagination. The chocolate and orange material which came in with the Brighton electrics is in more unconventional but in my opinion less good taste. It is to be hoped that the new green moquette velvet has come to stay.

Yours faithfully,

C. HAMILTON ELLIS

PUBLICATIONS RECEIVED

Gradients of the British Main Line Railways : Second (Revised) Edition. London : The Railway Publishing Co. Ltd., 33, Tothill Street, S.W.1. 9½ in. × 6½ in. 100 pp. Price 5s. net.—The first edition of this handy reference book, published at the end of June, was out of print within two and a half months. No time has been lost, however, in producing this second (revised) edition, in which opportunity has been taken to make a number of improvements. For instance, the profile of the Salisbury–Bathampton line has been added to the Great Western section, and, following the taking over for working purposes by the L.N.E.R. of the Midland & Great Northern Joint Railway, the gradients of this line have been transferred to the L.N.E.R. section. In several cases the profiles have been redrawn, making for greater clarity, and, following general appreciation, the expedient of printing the gradients of each railway on a paper of distinctive tint has again been adopted to facilitate quick reference. The same specially-selected type of paper has been used, moreover, to reduce bulk and permit the making of ink memoranda. The binding is also, as before, of stout limp cloth. It is obvious from the reception of the first edition of this handbook, which covers nearly 9,000 route miles of British railways, that railwaymen are finding it invaluable both as a reference work and as a travelling companion.

Die Selbsttätigkeit im Eisenbahnsicherungswesen (Automaticity in Railway Signalling). By Professor Dr. H. F. Arndt. Reprinted from the *Zeitschrift für das gesamte Eisenbahn-Sicherungs- und Fernmeldewesen*, Nos. 3, 4, 5, 1936. Berlin-Friedenau, Dr. A. Tetzlaff, Verlag, Wielandstrasse 8. 8¼ in. × 11¾ in. 20 pp. Illustrated.—Twice a year the divisional signal superintendents and inspectors of the German State Railway meet in conference and hear lectures on technical subjects, or pay visits to installations and signal works. The present publication comprises an address given to them by Professor Dr. H. F. Arndt, who is probably the leading authority today in Germany on the subject of automatic and power signalling, and has done much to assist in developing appliances for the purpose. Many able contributions to the literature of signalling have come from his pen, and the present one is fully on a level with its predecessors. It begins with a review of the present position of the signalling art and the requirements arising from the tendency to faster speeds on the railway, and briefly explains the principles of two, three and four aspect signalling, presenting statistics concerning automatic and manually-operated systems. Under the latter, Dr. Arndt has chiefly in mind what are called in Great Britain lock-and-block systems, so that the comparison of the amount of line worked by both methods is not precisely what the terms imply to English ideas.

The working of the usual German lock-and-block with treadle release, or with either the magnetic tail signal detector or the axle counter, is explained, with illustrations of some of the latest devices ; the automatic block system is then considered. Fundamental track circuit methods are outlined and compared with intermittent contact systems, the latest type of internal spectacle light signal being illustrated. The rectified track circuit and the energy characteristics of some other types are discussed. An interesting comparative diagram is given showing a station on the Hamburg Elevated Railway before and after conversion to track circuit working, and the advantages gained are set forth. There is also an illustration of the fine Stadion (Stadium) signal box in Berlin.

Level crossing signals are briefly touched on, and the author then passes to the highly important question of automatic train control, with a short reference to centralised point and signal control. The continuous and intermittent inductive systems are described ; the latter, having been developed in considerable detail to meet the requirements of the German State Railway, is treated at some length, at least as regards its essential features. Of these, the provision for covering permanent way restrictions is one of the most interesting. The lecture concludes with the expressed conviction, which we fully share, that signal engineers will be able to give the railways whatever they ask in the future, as in the past. The diagrams reproduced are well drawn, the photographic reproductions good, and the paper of excellent quality.

The Correct Economy for the Machine Age. By A. G. McGregor. Third Edition. London : Sir Isaac Pitman & Sons Ltd., Parker Street, Kingsway, W.C.2. 8¾ in. × 5¾ in. × 1⅛ in. 353 pp. Price 6s. net.—This is another of the long line of books that discuss methods of achieving an objective never clearly and concisely specified. So far as we can gather, the author does not differ from other authors of recent books on economics in being mainly concerned to find a way of assuring that everyone shall be employed, and that at the same time everyone shall be rewarded for his work sufficiently to make possible the purchase of the product of his industry or its equivalent. The existing economy seems to us to be as efficient as possible for this objective, although, short of war, we cannot see how paid employment for all men can be achieved under it. If, however, what we believe to be the true objective of individuals—namely, the maximum of unrestricted leisure (which does not mean idleness) and security, regardless of paid employment—were to be specified, a radical modification would be necessary, so that the whole output of productive capacity could be distributed, if it were wanted, instead of being restricted as at present. It is fundamentally erroneous to suppose that the object of industry is to provide work. It is, on the other hand, to provide the maximum of leisure in which individuals shall be free to choose the most congenial means of absorbing their energy.

Winter Sunshine.—"Follow the sun across the seas" is the motto recommended to readers of "Winter Sunshine," a new illustrated travel booklet issued by Thos. Cook & Son Ltd., Berkeley Street, London, W.1. With it we have received a folder, "The Nile Voyage," giving descriptive itineraries, fares, sailings, and other information regarding the Cairo-Aswan, and Aswan-Halfa voyages of the Nile steamers. The "Winter Sunshine" booklet lists independent tours in the Far East, India, Burma, Ceylon, Australasia, America, and the West Indies, together with round-the-world cruises. For those with less time to spend in the pursuit of winter sunshine there are shorter cruises to Madeira, and so forth.

High-Speed Tools.—Edgar Allen & Co. Ltd., of Imperial Steel Works, Sheffield, describes in a new illustrated folder the special qualities of Stag Major Superweld tools. These have ends of Stag Major high-speed steel solid-welded on to the steel shanks, and are hardened by experts. High speeds and heavy feeds can be used on difficult materials without fear of the ends breaking off. The standard shapes and sizes are shown in a chart with the folder, but tools can also be supplied to customers' own designs. Experiments have shown that the Stag Major Superweld principle results in a much longer life than is obtainable with ordinary tipped tools, the durability being the same as that of a solid tool. Special grinding wheels are unnecessary for sharpening, as the solid high-speed ends do not glaze a wheel as do mild steel and high-speed steel in combination as in a brazed type tipped tool.

Electric Heating Elements.—We have received from George Bray & Co. Ltd., Leicester Place, Blackman Lane, Leeds, an illustrated catalogue of Chromalox electric heating elements of various types. Flat and finned strip heaters, ring elements, and boiling plates (for cooking or other purposes) occupy one section of the catalogue, while the remainder deals chiefly with immersion heaters of various types for liquids or for viscous materials. For commercial use, special cartridge type immersion elements are listed, having great mechanical strength and a high insulation resistance. They will withstand vibration and give long service without attention. Several radiators suitable for railway use is shown, and an Armstrong Whitworth diesel railcar in which Chromalox heating elements have been used is illustrated. These radiators have metal-clad elements, and will stand up well to mechanical shocks.

THE SCRAP HEAP

"Guard against flu," reads a newspaper heading. Most of our guards are very much against it.

* * *

The oldest Great Western Railway horse in the service is a roan mare bought in March, 1917, and attached to the Hockley goods depot at Birmingham.

* * *

WHY U.S.A. TRAINS ARE LATE

Kissing is seriously interfering with train schedules on the Boston and Maine expresses, U.S.A. conductors complain. "When the train stops," one of them told the Central News, "75 per cent. of the passengers turn around and start kissing. When daddy is leaving mother and three or four youngsters, work it out for yourself how long it is before he actually boards the train."

* * *

G.W.R. INSPECTOR TAKES THE CAKE!

A Great Western Railway ticket inspector has just taken the cake. It was presented to him by a party of teachers and students from the Birmingham Central Technical College, for services rendered when two members of the party on a visit to London missed their train from Birmingham. On hearing this while *en route* to Paddington, the inspector promptly despatched a wire from the next stopping station, telling the missing students to proceed by the next train, and the place and time where they could connect with the main party in London. This they did. A few days ago the inspector received a large iced cake, decorated to tell its own story in the following stanzas:—

Two members of our party
Who missed the early train
Were able, through your kindness,
To catch us up again.

This little cake we send you
With very many thanks
And wishes for your future
In the higher grades and ranks.

Around the side of the cake were drawn signals and other railway emblems.

* * *

When a collection of pictures was being disposed of some years ago, one of them was described as being from the collection of L. Redpath, Esq., 1857. Redpath, who posed as a society man, a patron of the arts, and a philanthropist, was in the service of the Great Northern Railway Company, and his exposure was brought about by a curious coincidence. One morning a peer was in conversation with the Chairman of the company when Redpath came along. He was about to pass when the peer stepped aside and shook him by the hand, said a few words to him, and returned to the Chairman. "Do you know our clerk?" asked the Chairman. "Oh, yes," was the reply, "he gives first-class dinners, and is one of the best fellows in the world." This caused the Chairman to make some inquiries, for Redpath's position on the company was hardly in accordance with such social attainments, as he was only in charge of the transfer department. The result of that inquiry is railway history, for it revealed the fictitious issue of a quarter of a million railway stock. Redpath went over to Paris, but returned, was convicted and transported. As indicated, he had been a patron of the arts, and his West-End mansion was a treasure-house of beautiful things.

* * *

CEMETERY TRAIN

One of the strangest railway services in the whole country is the bi-weekly train service from the private station of a necropolis to Brookwood Cemetery, which is having more passengers than usual at this time because many visitors to London are taking the opportunity to visit the graves of relatives and friends there. The train, which bears hundreds of mourners to and from Brookwood, a journey of 28 miles, runs non-stop into the consecrated ground, where there are two railway stations—one for the Church of England section and the second for the Nonconformist and other denominations. It is regarded as the largest and one of the most beautiful, as well as the most cosmopolitan, burying-grounds in the United Kingdom.—*From the "Glasgow Herald."*

* * *

THE 5.20 PULLS IN AGAIN

Times have certainly changed. I was down-state the other evening at the county seat and a member of the family was going away. And gosh all hemlocks! It was exciting. For the young woman who was going away was going away on a *train*. For years and years when somebody was going away they just walked out of the house, got into the automobile, and away they went. But going away on a train is something entirely different. Everybody piled into autos and formed an escort to the depot. And then somebody went in to ask if the train was on time—just like people did away back years and years ago. And then the messenger came out and said the train was ten minutes late—just as they said in the old days. There was a crowd on the station platform—not such a big crowd as there used to be, for no one was on the platform except the people who were going away or who were waiting for friends to arrive on the train. Years and years ago, long before there were any automobiles, people went down to the depot just to see the train come in. It was one of the big moments of life in a small town. We haven't got back to that yet, but, anyhow, we've got back to going away on the train. And when it came snorting and puffing ponderously into the station our train passenger was put aboard and everybody shrieked "Good-by," and then the conductor of the train looked at his watch and shouted, "All aboard!" and the bell clanged and the whistle blew and the train was off. And we all ran down the platform and waved our hands and shouted good-by, and our little going-away girl looked out of the window and blew kisses and waved back at us until the train was of sight. It was all very exciting. Going away in an automobile is so very commonplace. But when somebody goes away on a train and you go down to the depot to see them off—well, it's a thrill and a memory, that's what!—*From "A Line O' Type or Two," in the "Chicago Daily Tribune."*

* * *

THE FIRST SLEEPING CAR

Early days of railways formed the subject of an interesting exhibition of lithographs and printed handbills recently arranged by the Chevrolet Motor Company in the General Motors Building, Detroit. Included among the specimens was a notice, dated January 25, 1838, of passenger and freight service on the Cumberland Valley Railroad, which announced that on the following February 1 "the regular train of passenger cars will commence running daily" between Chamberburg and Harrisburg. It will be remembered that two years ago we referred to the strong claims of this railway to have introduced the first sleeping car in the world, when the line in question was opened in November, 1837. Our editorial article of August 24, 1934, was followed by an interesting correspondence.

Careful stowing—in truck, lorry or on the deck—will prevent damage and your constant alertness in this direction is essential.

**DON'T TRUST TO LUCK,
IT MAY BE OUT
—AND SO MAY THE CONTENTS OF THAT PACKAGE**

No. 10 of a series of "claims prevention" posters recently issued by the Chief Goods Manager, Great Western Railway, for exhibition to the staff

XUM

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

INDIA

Railway Problems Discussed

On their visit to Bombay, the Chief Commissioner and the Financial Commissioner of Railways conferred with the Agents of the G.I.P. and B.B. & C.I. Railways on the question of economy in railway working with special reference to staff reductions. They also met the representatives of various commercial bodies to discuss railway problems affecting public interests. Sir Rahimtoola M. Chinoy, President of the Indian Merchants' Chamber, speaking on behalf of the Committee of the Chamber, was against the immediate establishment of a federal railway authority, and pressed for an inquiry into railway finances, not by one or two experts, but by a competent committee on which Indian commercial interests were well represented. On the question of the proposed increase of railway rates by reclassification, Sir Rahimtoola stated that the committee of the Indian Chamber firmly believed that increased revenue would rather be achieved by a judicious reduction of rates and fares. Similar views on this subject were expressed by the committee of the Bombay Chamber of Commerce.

Sir Rahimtoola said that his committee desired to emphasise the importance of a comprehensive system of road transport as an integral part of the system of internal communications in the country. Other points dealt with by the commercial interests of Bombay included facilities for insurance surveys before the removal of goods from railway premises, risk notes, and railway receipts as negotiable instruments.

ARGENTINA

Tenders for Grain Elevators

The Ministry of Agriculture has called for tenders for the construction of the second group of terminal grain elevators, to be erected at the ports of Santa Fé, Buenos Aires (Riachuelo) ("Compañia General de Ferrocarriles"), Diamante (State Railways), Concepción del Uruguay (Entre Rios Railways), and La Plata (B.A.G.S. and B.A. Provincial Railways), at an estimated cost of $15,000,000 paper. The Santa Fé elevator will have a storage capacity of 50,000 tons, and each of the other four 20,000 tons. It is announced that calls for tenders for the third group of terminal elevators to be constructed at San Nicolás (Central Argentine Railway), Mar del Plata (B.A.G.S.R.) and General José F. Uriburu (port of Zárate, Central Argentine Railway) will shortly be made. The combined capacity of the three last-mentioned structures will be about 85,000 tons, and their cost is estimated at $7,500,000 paper. Thirty-nine firms submitted tenders for the first group of terminal elevators, details of which were published in THE RAILWAY GAZETTE of June 5 last.

SPAIN

The Civil War and its Effects

According to *El Heraldo* of Madrid, the employees of the Madrid Metro have organised a subscription, which already amounts to over 14,000 pesetas, for the injured and invalided among the Government militia since the beginning of the civil war. Also, the paper says, the management of the company, on the petition of the workers' representatives, has handed over to the Central Aid Committee an amount of 50,000 pesetas for the same object.

Workers' Control of Power Company

The Workers' Committee in Barcelona notified the management of the Barcelona Traction Light & Power Company on August 28 that it had taken over complete control of the concern. The company is a Canadian-formed concern controlled by Société Internationale d'Energie Hydro-Electrique (Sidro). It controls the Ebro Irrigation and Power Company and Energia Electrica de Cataluna. The companies supply 89-90 per cent. of all electric power and light sold in Barcelona and the Province of Catalonia, including, of course, current to most of the electric railways and tramway systems. For some time past, and indeed since the beginning of the civil war the company has suffered, in common with other undertakings in Spain, an ever increasing interference with the conduct of its affairs and this action of the Workers' Committee is the culminating point, the consequences of which it is impossible to foresee. It is not at present easy to say to what point the action of the committee is approved or supported by the Generalitat (the established Government of Catalonia) or by the Madrid Government, but it is to be assumed that the British Government will make a strong protest.

Madrid-Barcelona Communications

Through railway communication between Madrid and Barcelona is being maintained by way of Valencia. The way is open from Madrid to the provinces of Valencia, Alicante, and Murcia, and as long as this main line of railway can be kept open there is no fear of Madrid being starved out. The lines to the north are closed by the insurgent forces in the Guadarrama mountains, and there is very little fresh fish, as most of this normally reaches Madrid from Vigo and other northern ports. The same may be said of meat and milk and other dairy products, nearly all of which are supplied from the green pastures of Asturias and Galicia, although of late years much of the fish traffic has been carried by convoys of fast lorries on the roads. Among the most important trains on the Galicia line of the Northern system were the *ganaderos* or cattle trains.

Santander-Mediterranean Railway

A recent announcement of the Anglo-Spanish Construction Company states that the whole of the district served by the 366 kilometres of the Santander—Mediterranean Railway from Cidad to Calatayud, in Spain, lies within the area at present in the hands of the insurgents. According to the latest information received, the railway company's property has not suffered any damage, and normal train services are in operation. The company, which is controlled by the Central Mining and Investment Corporation, owns a concession for the building of a railway from Ontaneda to Calatayud. The concession is vested in a local subsidiary, the Santander—Mediterraneo Compania del Ferrocaine Estradegico de Santander—Burgos—Soria—Calatayud. On account of construction of completed sections, the Spanish Government owes the railway company 62,500,000 pesetas. The company has offered to abandon its undertaking to the Government merely for the equivalent of the sums due.

Bilbao River & Cantabrian Results

At an extraordinary general meeting of the Bilbao River & Cantabrian Railway Co. Ltd., held at Southern House, E.C., on September 9, a resolution was unanimously adopted that in view of the unsettled conditions in Spain, the powers of the directors be confirmed to take any steps necessary to safeguard the company's interests either by disposing of the property or terminating the business of the company in Spain in such other manner as they may deem desirable. Sir Edgar Horne, the Chairman, said that for some years past the actual business of the railway had not produced any profit, and the dividends distributed had been really derived from the interest on reserves invested in this country. The state of anarchy in Spain and the action of the Spanish authorities in persisting in their attempt to impose improper taxation, the impossibility of transmitting the company's funds to England and the vexatious regulations as to employment, hours of labour and reinstatement of employees, removed all hope of carrying on the railway without substantial loss, and absolved the company from any obligation to continue to provide the public service. The directors were

driven to the conclusion that in the absence of any sudden and unexpected turn of events it would be in the interests of the shareholders to seize any opportunity that might occur in terminating their commitments in Spain and bringing the business to a close.

Their primary object would be to escape any fresh liabilities in Spain which would delay the winding up of the company and the distribution among the shareholders of the assets and reserves in this country, but they would, of course, endeavour to obtain the best return possible for what, in normal times, was a valuable property.

SWITZERLAND

Success of Faster Services

The results so far achieved by the introduction of the Geneva-Zurich experimental light expresses, and the extension of the Red Arrow electric high-speed railcar services, are stated by the Federal Railways to have been entirely satisfactory. The new inter-city business expresses have been well patronised, and will continue to run throughout the winter. Between Geneva and Berne the standard composition of three coaches and van has usually been sufficient, but it has frequently been necessary to provide two additional coaches between Berne and Zurich, thereby increasing the weight of the train from 150 to 230 tonnes. In spite of the fact that the route is a busy one, yet partly single-track, the new trains have been running very punctually and lost time has invariably been made up. It has been ascertained that the total number of passengers using these trains and the regular expresses between Berne, Bienne and Zurich, shows a slight increase over last year's figures for the same period; the steady drop in traffic has therefore been stayed in this particular case by the provision of a fast service, though west of Berne there was a slight falling-off.

The success of the Red Arrow railcars has already been referred to in THE RAILWAY GAZETTE. Immediately after the first two cars were placed in service last year, it was found that they attracted so much traffic that they had to be replaced on Saturdays and Sundays by light trains consisting of an engine or ordinary motor-coach with two or three trailers. When additional Red Arrow cars were introduced on May 15 last, the one operating from Zurich soon proved so successful that on most of the services it had to be withdrawn, and replaced by a light train of greater capacity. That the increase of traffic so obtained was not due merely to the attraction of novelty is shown by the fact that the light trains continued to be as well patronised as the railcars. Red Arrows released from regular services, and the spare cars, are extensively used for excursion traffic, mainly over long distances, such as Lake Constance—Lugano, and Geneva—Schaffhausen.

CZECHOSLOVAKIA

New Railway Opened

An important new line was opened for traffic on July 26, namely the last section of the Cervena Skala-Margecany Railway, which is 92·5 km. (58 miles) in length. Construction has taken five years and has cost some 256,000,000 crowns. It completes a second west-to-east route throughout the country, and is about 100 km. shorter than the more northerly Bohumin-Kosice line.

This new transversal line links up Prague with Bratislava via Bauska Bystrica, and as well as providing a new east-to-west connection of considerable economic importance, it opens up a region likely to become a tourist centre. Through the Low Tatras its altitude ranges from 1,100 ft. to 2,624 ft., and it is expected to tap districts where mining towns flourished in the Middle Ages, and to revive the mineral wealth of that area, that has been lying dormant for centuries due to lack of communications.

The engineering difficulties of the construction were great, due to the mountainous character of the terrain, and nine tunnels and numerous large viaducts had to be built.

UNITED STATES

Freight Rate Rise Uncertain

The railways have been denied the permission they sought from the Interstate Commerce Commission, to make permanent the rise in (selected) freight rates which they have been enjoying as an emergency measure. The rates will expire at the end of the year unless extended, and the railways wished to incorporate the increase in permanent tariffs. Their contention was based upon the plea that, although traffics have materially increased, so have expenses; and that the railways are earning far below the standard to which by law they are entitled. In fact, net railway operating income (which is after all operating expenses, taxes, but before earnings from investments and before the payment of interest on bonds) was £47,648,000, in the first half of the year, which was at the rate of only 2·2 per cent. per annum on the capital investment.

New Tax Law Costly to Railways

The new tax law enacted by Congress prior to its recent adjournment has disclosed on closer examination a number of unexpected provisions, one of which will prove costly to the railways. The Act was intended to be a measure punitive against "intrenched greed," as well as a revenue measure, and provides for progressive taxes, up to 47 per cent., of company net earnings not distributed to shareholders. The Act is loosely worded and, as a result, sinking fund reserves on many issues of railway bonds will apparently be taxable at the punitive rates.

The Roosevelt administration has on many occasions criticised the railways for maintaining capital structures made up so largely of fixed-interest-bearing bonds. Though the sinking funds are the main reliance for correcting this condition, this new Government revenue measure makes the amassing of sinking funds more difficult than ever. Because of its inconsistency with the general policy of the Government, it seems probable that this feature of the Act was unintentional, and in that case the situation will probably be corrected before it has proved too costly to the railways.

"Off the Beaten Track" Excursions

The American railways have found a growing interest on the part of the public in Sunday excursions "off the beaten track," that is, to places not ordinarily reached by regular passenger trains. There are many such points of scenic, historical and industrial interest, particularly along the Eastern seaboard, which are known by name only to most railway travellers. On a Sunday recently the Pennsylvania operated an "off the beaten track" excursion westward from Philadelphia, traversing a number of branch lines not ordinarily served by passenger trains. Beside several historical spots, the train also stopped briefly at the company's large marshalling yard at Enola (near Harrisburg, Pa.) and at the huge dam over the Susquehanna river at Conowingo, Maryland, which is the source of much of the electric power by which the company's electric lines are worked. Over 500 passengers availed themselves of this excursion (which the company fosters to stimulate public interest in railway working rather than for the additional revenue obtained). Other railways are planning similar facilities for journeys "off the beaten track," with excellent prospects of success.

JAPAN

Streamlined Train Sets for Electric Services

New four-car electric train sets have been put into service on the Tokyo-Yokohama, and Osaka-Kobe sections of the Government Railways. The trains have a motor coach at each end, and two trailers in between. The coach bodies are of welded steel, and the sets are streamlined at both ends; the underframes are partly covered on the outsides by steel plating, otherwise the sets follow the arrangements embodied in the existing electric rolling stock. All doors have pneumatic opening and closing apparatus, operated from both ends. The sets are used on the non-stop services between the cities mentioned. When all the present four-car sets have been replaced, similar stock will be introduced for the two-car sets used on stopping trains.

XUM

HILL RAILWAY VIADUCT RECONSTRUCTION

Describing the replacement of a masonry gallery by a specially designed steel trestle bridge—with calculations—on the Kalka-Simla Section, N.W.R., India

THE 2 ft. 6 in. gauge Kalka-Simla mountain railway—now forming part of the North Western Railway—was opened at the beginning of the twentieth century. Most of the bridges on this line, which appears to cling perilously to the steep mountain sides throughout most of its 60-mile length, consist of multi-arch masonry viaducts, sometimes three and more storeys high, known as galleries; one of these we illustrate. Single-storey gallery No. 826, situate about half a mile below Simla station, showed signs of deterioration early in 1933, and in August of that year three of the nine 15-ft. arches and three piers were reported badly cracked. As a precaution clusters of rails were laid under the track to avoid as far as possible local concentration of load, the speed of trains was restricted to 5 m.p.h. and the gallery was kept under close observation.

As matters grew worse it was found necessary to rebuild the structure, and Mr. Everall, Bridge Engineer, N.W.R., decided to replace it with a steel trestle viaduct, without either putting in a diversion or interfering with the intensive summer traffic. Such a diversion would have been very costly in view of the awkward location of the gallery on steep hillside, partly on a curve, on a 1 in 42 grade, and only a few yards from the mouth of a tunnel, as may be seen from Fig. 1.

The type of trestle was designed to carry standard M.L

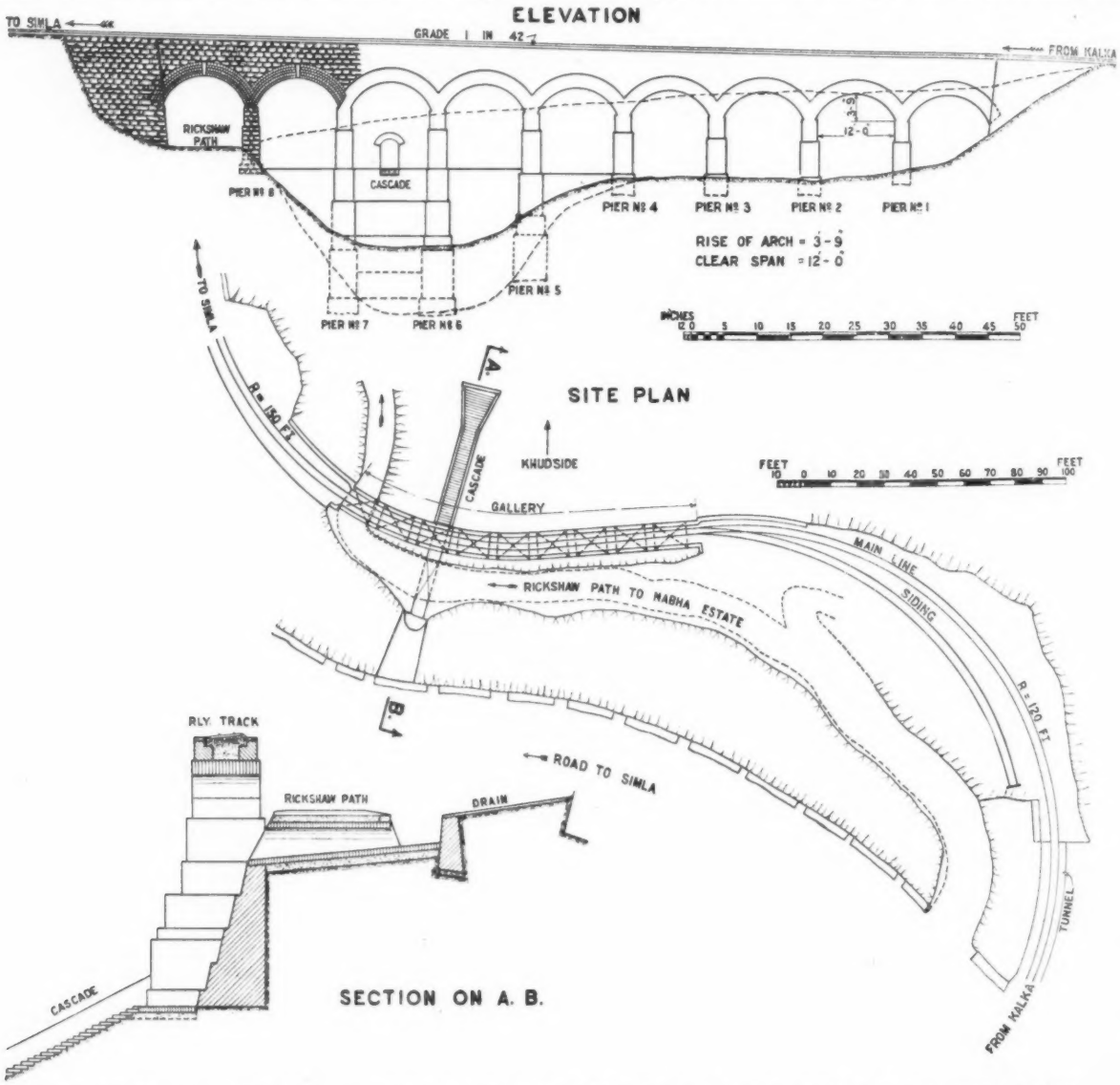


Fig. 1—Elevation, plan and cross section of gallery No. 826 prior to its being rebuilt as a steel trestle viaduct. (Upper scale refers to elevation and cross section; lower scale to plan)

SECTIONAL ELEVATION

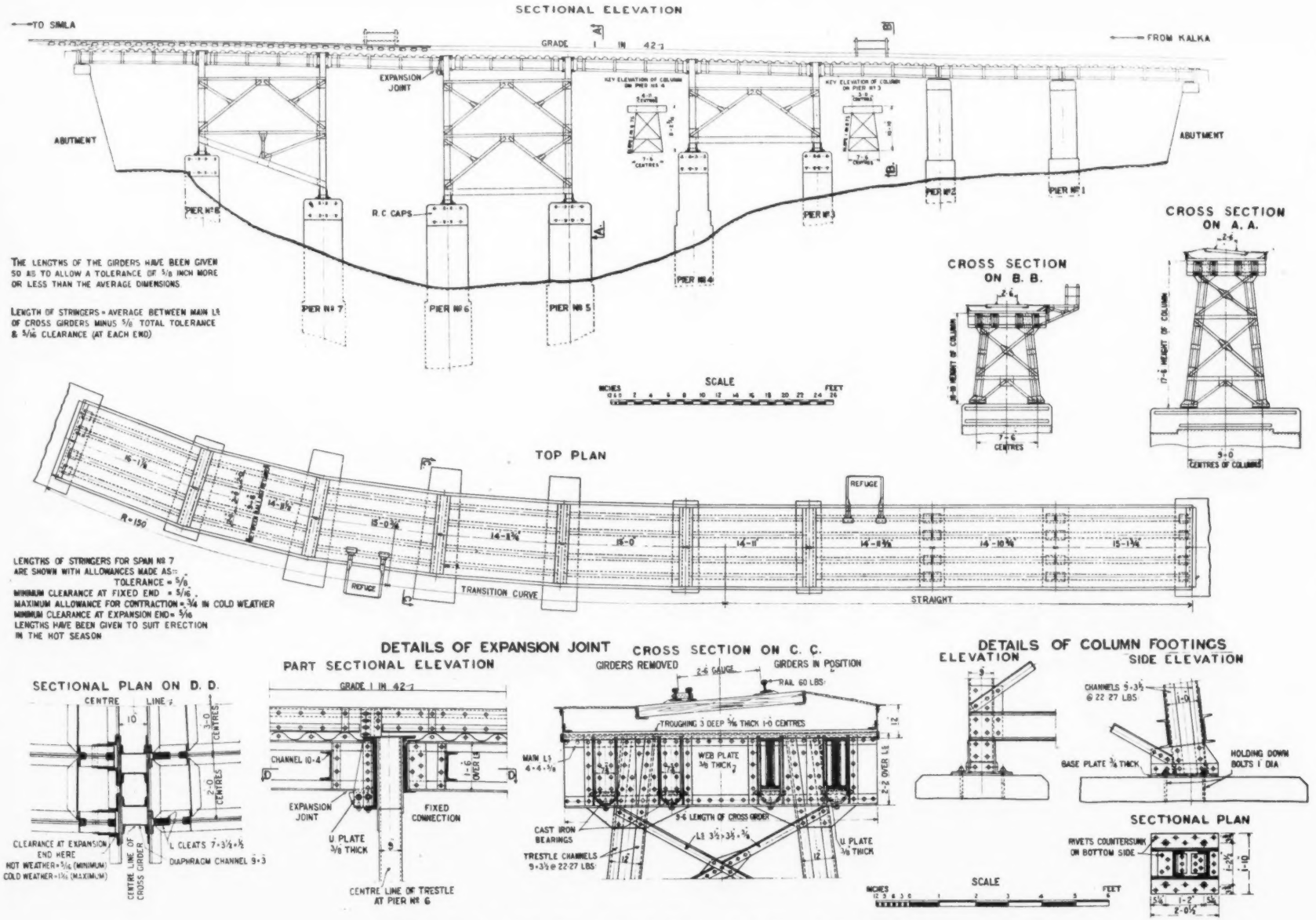

SECTIONAL ELEVATION
TO SIMLA
FROM KALKA
GRADE 1 IN 42·1
EXPANSION JOINT
ABUTMENT
ABUTMENT
PIER No 8
PIER No 7
R.C CAPS
PIER No 6
PIER No 5
PIER No 4
PIER No 3
PIER No 2
PIER No 1
THE LENGTHS OF THE GIRDERS HAVE BEEN GIVEN SO AS TO ALLOW A TOLERANCE OF 5/8 INCH MORE OR LESS THAN THE AVERAGE DIMENSIONS
LENGTH OF STRINGERS = AVERAGE BETWEEN MAIN L'S OF CROSS GIRDERS MINUS 5/8 TOTAL TOLERANCE & 5/16 CLEARANCE (AT EACH END)
SCALE
CROSS SECTION ON B. B.
CROSS SECTION ON A. A.
TOP PLAN
R=150
REFUGE
REFUGE
TRANSITION CURVE
STRAIGHT
LENGTHS OF STRINGERS FOR SPAN No 7 ARE SHOWN WITH ALLOWANCES MADE AS:-
TOLERANCE = 5/8
MINIMUM CLEARANCE AT FIXED END = 5/16
MAXIMUM ALLOWANCE FOR CONTRACTION = 3/4 IN COLD WEATHER
MINIMUM CLEARANCE AT EXPANSION END = 5/16
LENGTHS HAVE BEEN GIVEN TO SUIT ERECTION IN THE HOT SEASON
SECTIONAL PLAN ON D. D.
CENTRE LINE
CLEARANCE AT EXPANSION END HERE
HOT WEATHER = 5/16 (MINIMUM)
COLD WEATHER = 1 3/16 (MAXIMUM)
CENTRE LINE OF CROSS GIRDER
L CLEATS 7·3½·½
DIAPHRAGM CHANNEL 9·3
DETAILS OF EXPANSION JOINT
PART SECTIONAL ELEVATION
GRADE 1 IN 42·1
CHANNEL 10·4
EXPANSION JOINT
FIXED CONNECTION
U PLATE ⅜ THICK
CENTRE LINE OF TRESTLE AT PIER No 6
CROSS SECTION ON C. C.
GIRDERS REMOVED
GIRDERS IN POSITION
2-6 GAUGE
RAIL 60 LBS
TROUGHING 3 DEEP 5/16 THICK 1-0 CENTRES
MAIN L'S 4·4·⅝
WEB PLATE ⅜ THICK
9-6 LENGTH OF CROSS GIRDER
CAST IRON BEARINGS
TRESTLE CHANNELS 9·3½ @ 22·27 LBS
U PLATE ⅜ THICK
DETAILS OF COLUMN FOOTINGS
ELEVATION
SIDE ELEVATION
CHANNELS 5·3½ @ 22·27 LBS
BASE PLATE ⅞ THICK
HOLDING DOWN BOLTS 1 DIA
SECTIONAL PLAN
RIVETS COUNTERSUNK ON BOTTOM SIDE
SCALE

Fig. 4—Sectional elevation and details of design of steel viaduct

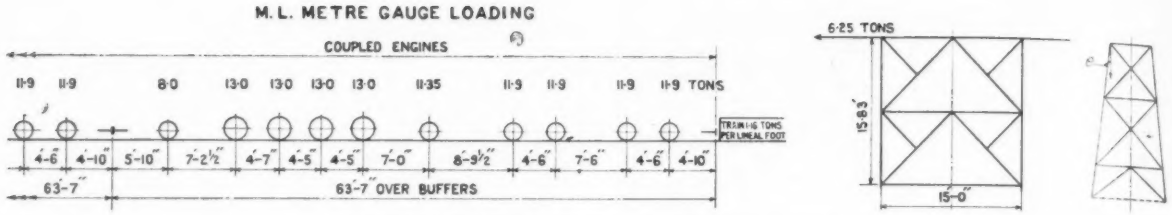


Diagram of loading used for calculating stresses

(Main Line) metre gauge loading, *i.e.*, two eight-coupled 13-ton axle locomotives followed by a train of 1·16 tons per lineal ft., it being standard practice on Indian railways to design all 2 ft. 6 in. gauge lines and structures for metre gauge loading. The determination of stresses in the main and cross girders was straightforward, but the loading on the main column legs of the trestles was slightly more complex and details showing the various forces taken into account are given below. Particulars of the stress diagram and the tabulated stresses are given in Figs. 2 and 3 respectively. Forces exerted on one pair of columns of one trestle from the following causes were allowed for:—

(i) Dead weight of superstructure and trestle itself: dead load on one pair of columns = 10·60 t.

(ii) Live load of train itself, *i.e.*, its weight. The equivalent uniformly distributed load on a span of 30 ft. was taken and divided by 2 to give the total reaction on one pair of columns. Live load on one pair of columns = 39·30 t.

(iii) Impact effect: In accordance with the practice in vogue on the N.W.R., the impact factor was calculated from the formula: impact factor $= \frac{65}{45 + L}$ where L = length of the span in feet: (in this case 30 ft. for cross girders and columns); impact on one pair of columns = 34·10 t.

(iv) Centrifugal force due to the passage of the train on the curve of 150-ft. radius. This horizontal force, assumed to be acting through the centre of gravity of the live load (in this case the locomotives), was calculated from the formula

$$C = \frac{W V^2}{15 R},$$

where C = horizontal force in tons per foot-run of the span, and W = equivalent uniformly distributed live load in tons per foot run (for bending moments), W = 39·3 ÷ 15 t. p. ft. run., V = maximum speed of live load = 15 m.p.h., and R = radius of curvature of track, in feet (R = 150 ft.). Centrifugal force on one pair of columns = 3·93 tons.

(v) Wind load of 30 lb. per sq. ft. on train and trestle. This was taken to be acting in the same direction as the centrifugal force. The force of 30 lb. per sq. ft. was assumed to be acting all over the exposed surface of the windward columns and bracings and over 75 per cent. of those on the leeward side.

The horizontal force on one pair of columns due to the wind on—(*a*) the train = 1·91 t., (*b*) the superstructure, *i.e.*, girders, &c., = 0·50 t., (*c*) the trestle = 0·94 t. The distribution of wind and centrifugal forces has been shown on the diagram of forces.

(vi) Force due to the tractive effort and the braking effect of the live load:—In accordance with the rules, this force was determined by multiplying the equivalent uniformly distributed live load (used for calculating the bending moment in main girders) by the factor: $\frac{20}{L + 55}$,

where L = loaded length in feet (30 ft.).

Of the total force due to tractive effort or braking effect, the rules state that 6 tons may be assumed to be dispersed through the running rails in the case of M.L. metre gauge.

Thus: tractive force on one trestle = 18·5 t., dispersion through track = 6 t., net horizontal force on one trestle = 12·5 t.

Vertical reaction due to tractive effort, &c., on one pair of columns $= \frac{12{\cdot}50 \times 15{\cdot}83}{15} = 13{\cdot}16$ t., and on each inclined column (inclined to the vertical by angle θ) the reaction $= \frac{13{\cdot}16}{2} \times \sec.\ \theta =$ 6·62 t.

Details of the design of the trestle are shown in Fig. 4. As will be seen the columns are founded on the cut-down stumps of the old piers, the tops of which have been finished off with concrete caps reinforced by rails. The batter of the trestle legs has been kept uniform in all cases to avoid complications with bracings, the extra height for the pairs of longer columns of each trestle being allowed for by lengthening at the top, thus reducing the transverse width between them from 5 ft. to 4 ft. 11 in.

A notable feature was the location of these trestles on the old piers and the consequent positioning of the cross girders at places where they could be threaded through the masonry without interference with the arch rings themselves. The stringers, four in each span, are placed between the cross girders, and an expansion joint has

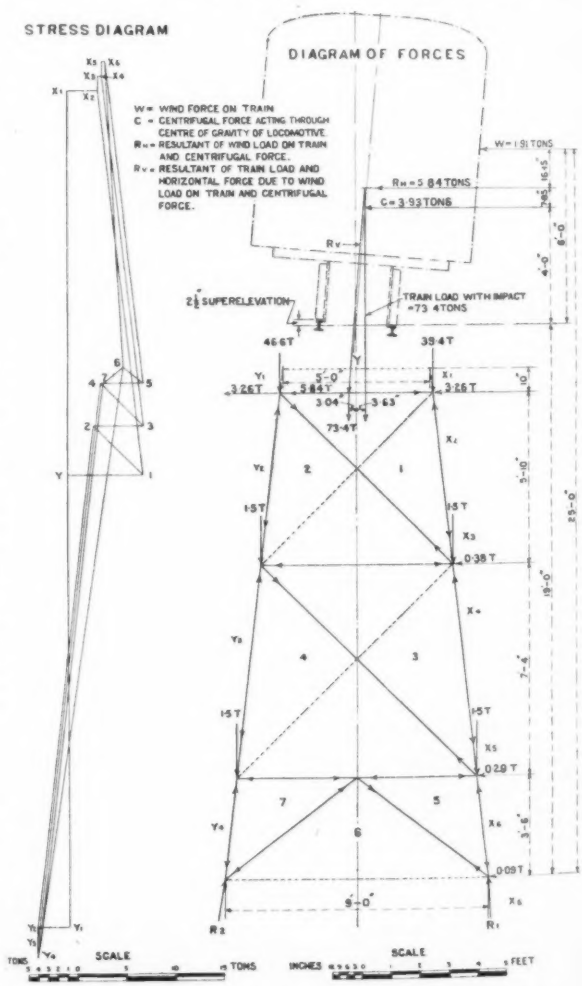


Fig. 2—Stress diagram of steel trestle in new viaduct

TABLE OF STRESSES

	MEMBERS	SECTION USED	STRESS DUE TO LIVE LOAD, DEAD LOAD WIND & CENTRIFUGAL FORCES IN TONS	STRESS DUE TO TRACTIVE FORCE IN TONS	MAXIMUM STRESS IN TONS	AREA OF CROSS SECTION IN INCHES	STRESS IN TONS PER SQUARE INCH	VALUE OF L ÷ R *	MATERIAL	PERMISSIBLE STRESS IN TONS PER SQUARE INCH	REMARKS
MAIN COLUMNS	X_2-1	2 CHANNELS 9" × 3½" @ 22·27 LBS 2 STIFFENING PLATES 6⅞ × ⅜/16	+39·7	+6·62	46·32	17·32	2·67	24·1	STEEL	7·51	
	X_4-3	"	+36·1	"	42·72	"	2·47	24·7	"	7·50	
	X_6-5	"	+33·4	"	40·02	"	2·32	"	"	"	
MAIN COLUMNS	Y_2-2	"	+52·0	+6·62	58·62	17·32	3·38	24·1	STEEL	7·51	
	Y_3-4	"	+57·8	"	64·42	"	3·72	24·7	"	7·50	
	Y_4-7	"	+59·3	"	65·92	"	3·80	"	"	"	
CROSS GIRDER	Y-1	4 L⌀ 4·4·⅜ 2 PLATES 20·⅜ 15/16 DIA HOLES	+7·5	-		GROSS AREA 33·44	1·26 (-) 1·54 (+)	-	W. I	6·0 (-) 6·8 (+)	INCLUDING BENDING STRESSES.
HORIZ. ANGLES	2-3	2 L⌀ 5·3·⅜	+5·0	-	+5·0	5·72	0·87	73	"	5·17	
	4-5	"	+4·3	-	+4·3	"	0·75	46	"	5·76	
	4-7	"	+0·2	-	+0·2	"	0·03	46	"	5·76	
DIAGONALS	1-2	2 L⌀ 3½·3·⅜ 15/16 DIA HOLES	-7·1	-	-7·1	4·0	1·78	-	W. I.	6·0	
	3-4	"	-6·0	-	-6·0	"	1·50	-	"	"	
	5-6	"	-2·6	-	-2·6	"	0·65	-	"	"	
	6-7	"	+2·6	-	+2·6	GROSS AREA 4·60	·57	53	"	5·6	

MINUS SIGN (-) INDICATES TENSION
PLUS SIGN (+) " COMPRESSION

* L = GREATEST UNSUPPORTED LENGTH
R = MINIMUM RADIUS OF GYRATION

Fig. 3—Tabulated stresses in trestle

been provided over the sixth pier. The shoring up of the arches and the arrangement of the staging used during the reconstruction are shown in Fig. 5, whilst Fig. 6 shows the sequence of operations.

The first operation consisted in shoring up the arches and erecting the staging along the outside of the gallery. On the tops of N.W.R. standard interchangeable staging columns, temporary girders were erected parallel with the sides of the masonry gallery. These were so arranged that the permanent cross girders could be threaded through the masonry and connected to the webs of these temporary plate girders.

Work at site had commenced about the end of February, and the shoring up of the arches was well advanced before the annual uphill rush of traffic in April. During that month and the first half of May, work had to be slowed down considerably as the traffic movements were too frequent to allow of any periods for the blocking of the line. However, from the middle of May until the subsequent completion of the work in August, the engineers were given permission for one daylight block period of two and a half hours (5.30 a.m. until 8 a.m.) daily and, occasionally, by special arrangements, some time was allowed during the night.

In the second operation, the cross girders were inserted in position, and the temporary rail clusters, previously put in to relieve the cracked arches, were removed. The insertion of the cross girders was accomplished in two block periods. During the first, the spandrel walls at the haunches were dismantled and a small sleeper crib was built to support the track temporarily and also to retain the rest of the fill. Then in the subsequent block period, the top layers of the crib, as found necessary, were removed and the cross girder inserted and the connections to the temporary main girders bolted up, the rest of the crib being left in to retain the fill.

In the next operations (*vide* stage 3, Fig. 6) the inner pairs of the permanent stringers were put in, bolted up to the cross girders, and the load transferred to the staging. The insertion of each pair of stringers together with the temporary bridge timbers or sleepers which had previously been fitted, occupied one block period. On the completion of this work, the dismantling of the arches was taken in hand, from both ends of the bridge simultaneously.

As each pier was dismantled, the casting of the r.c. cap was taken in hand. For the stone masonry, cement and sand mortar, in the ratio of 1:3 was used and for the r.c. caps and bedstones a 4:2:1 concrete was used. In the case of the masonry mortar, the sand, obtained locally, proved suitable for the work; but, it was necessary to wash it well before mixing. The stones for the masonry were obtained from the dismantled piers. For the r.c. work, better materials were necessary and were brought from a distance. As regards the cement, Swasticrete quick-setting cement was used for the r.c. caps and bedstones, ordinary Punjab cement being used for the stone masonry. No load was applied to any concrete work until five days had elapsed after casting with quick-setting cement and fourteen days in the case of Punjab cement. As the weather was very damp at the time this work was being carried out, there were no difficulties about curing.

In the next operations (stage 4, Fig. 6), the trestles themselves were erected. These were all fabricated, erected, marked and dismantled in the N.W.R. bridge workshop at Jhelum, much of the material being taken from the stock of girders collected after removal from

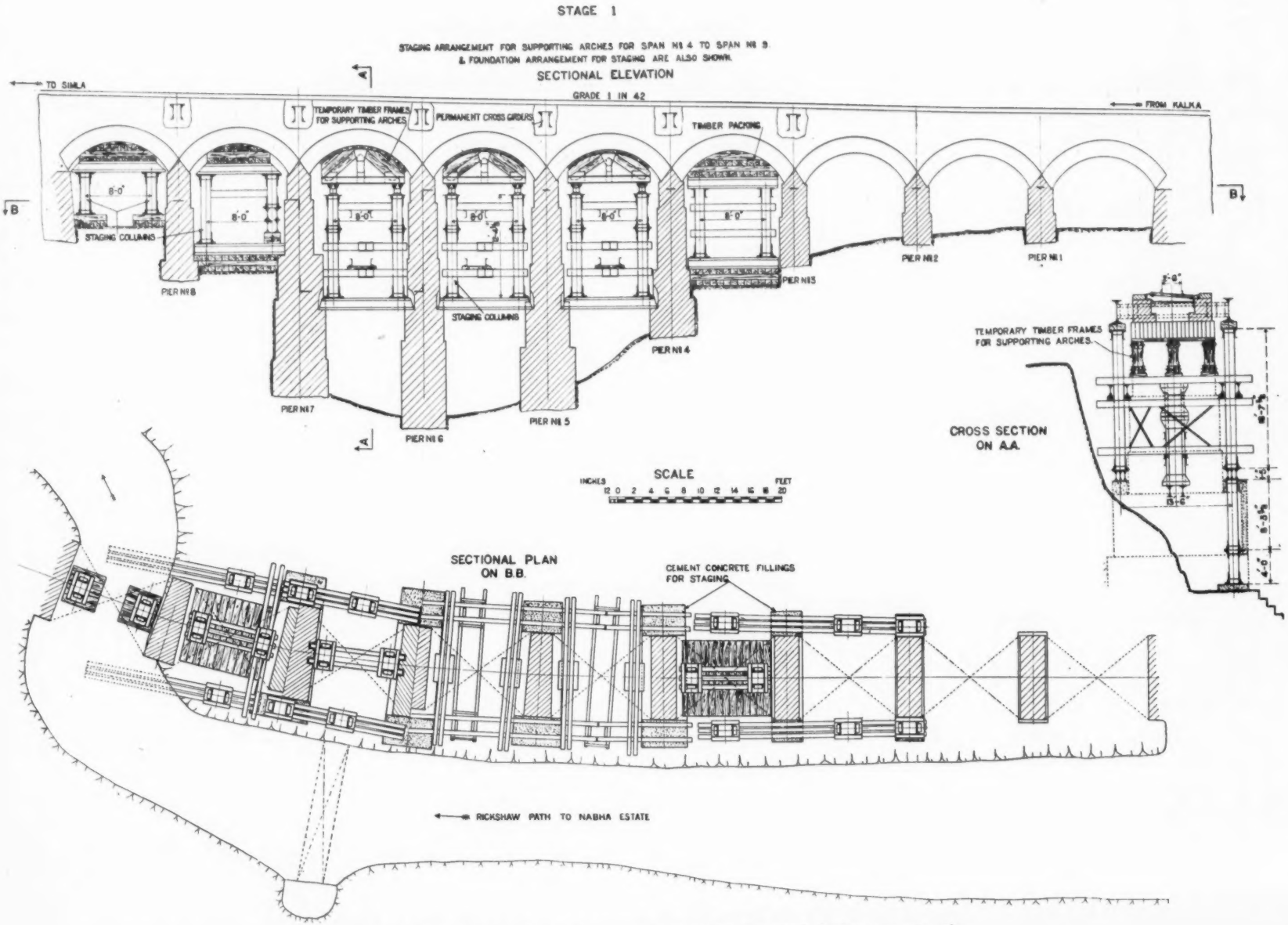


Fig. 5—Shoring of arches and arrangement of staging used during reconstruction

Fig. 5—Shoring of arches and arrangement of staging used during reconstruction

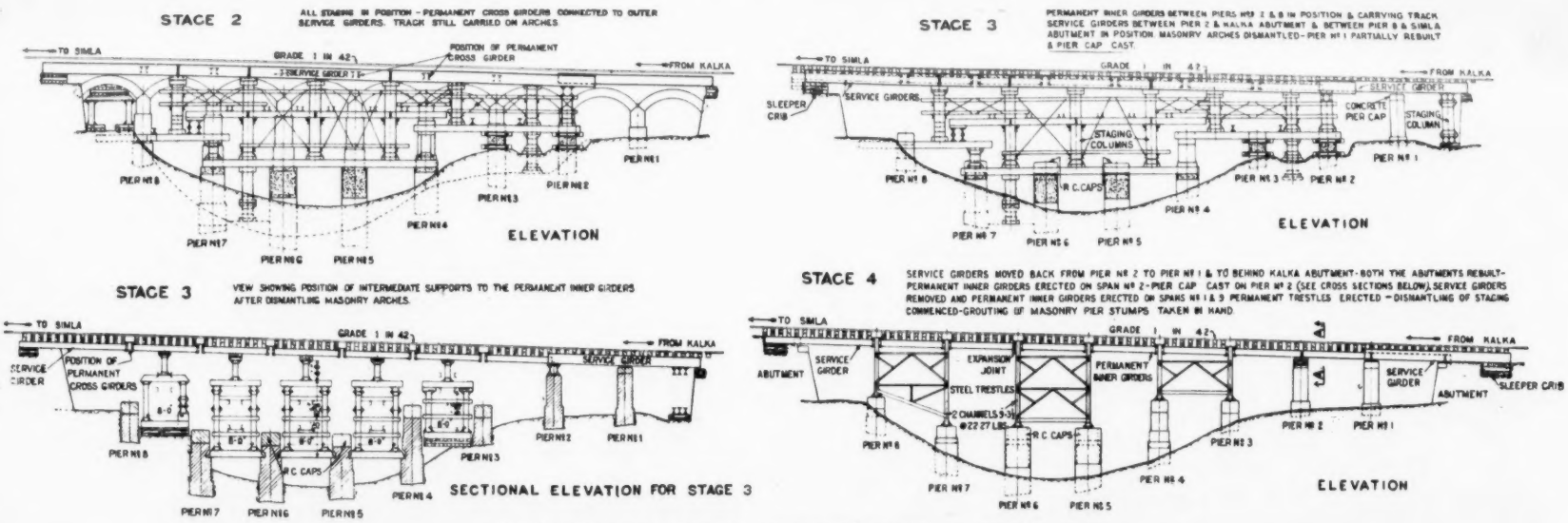
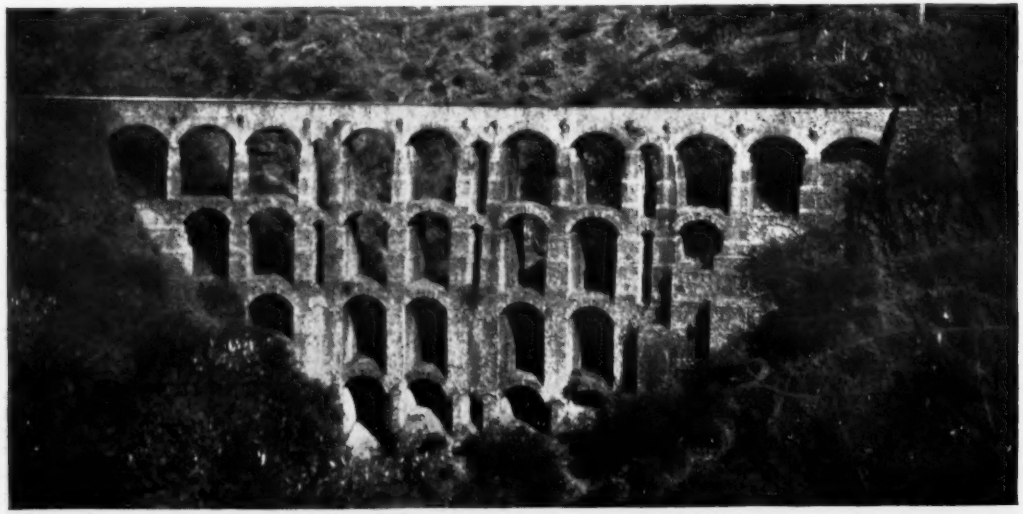

STAGE 2
ALL STAGING IN POSITION - PERMANENT CROSS GIRDERS CONNECTED TO OUTER SERVICE GIRDERS. TRACK STILL CARRIED ON ARCHES
TO SIMLA
GRADE 1 IN 42
POSITION OF PERMANENT CROSS GIRDER
FROM KALKA
SERVICE GIRDER
PIER № 8
PIER № 7
PIER № 6
PIER № 5
PIER № 4
PIER № 3
PIER № 2
PIER № 1
ELEVATION
STAGE 3
PERMANENT INNER GIRDERS BETWEEN PIERS № 2 & 8 IN POSITION & CARRYING TRACK. SERVICE GIRDERS BETWEEN PIER 2 & KALKA ABUTMENT & BETWEEN PIER 8 & SIMLA ABUTMENT IN POSITION. MASONRY ARCHES DISMANTLED - PIER № 1 PARTIALLY REBUILT & PIER CAP CAST.
SLEEPER CRIB
SERVICE GIRDERS
CONCRETE PIER CAP
STAGING COLUMN
R.C. CAPS
ELEVATION
STAGE 3
VIEW SHOWING POSITION OF INTERMEDIATE SUPPORTS TO THE PERMANENT INNER GIRDERS AFTER DISMANTLING MASONRY ARCHES.
SERVICE GIRDER
POSITION OF PERMANENT CROSS GIRDERS
SECTIONAL ELEVATION FOR STAGE 3
STAGE 4
SERVICE GIRDERS MOVED BACK FROM PIER № 2 TO PIER № 1 & TO BEHIND KALKA ABUTMENT - BOTH THE ABUTMENTS REBUILT - PERMANENT INNER GIRDERS ERECTED ON SPAN № 2 - PIER CAP CAST ON PIER № 2 (SEE CROSS SECTIONS BELOW). SERVICE GIRDERS REMOVED AND PERMANENT INNER GIRDERS ERECTED ON SPANS № 1 & 9 PERMANENT TRESTLES ERECTED - DISMANTLING OF STAGING COMMENCED - GROUTING OF MASONRY PIER STUMPS TAKEN IN HAND.
ABUTMENT
EXPANSION JOINT
STEEL TRESTLES
PERMANENT INNER GIRDERS
SLEEPER CRIB
ELEVATION

Fig. 6—Diagrams showing sequence of operations stage by stage



Typical masonry gallery on the Kalka-Simla line

Kalka to Simla train standing on rebuilt viaduct

HILL RAILWAY VIADUCT RECONSTRUCTION

various bridges all over the line. The connections between the cross girders and the trestles was made at site, the holes being drilled in position and temporarily bolted pending riveting up later on.

During the erection of the trestles, opportunity was also taken to grout up the old masonry remaining in the stumps of the piers, as at this time they carried little or no load, and the quality of the masonry work in the interior was found to be very poor. Holes spaced about 2 ft. 6 in. and 3 ft. apart, were drilled to a depth of about half the thickness of the masonry of the piers and pieces of 1-in. diameter iron piping 9 in. long were forced into these holes and cemented in position with quick-setting cement, the end protruding being screwed to make connection with a flexible hose from the grouting machine. A grouting pressure of about 20 lb. per sq. in. was maintained, the air being supplied from the same diesel-driven compressor as was used for operating the pneumatic tools. The average quantity of cement pumped into the piers was about 1·75 bags to each hole. The result of this grouting appeared to be satisfactory.

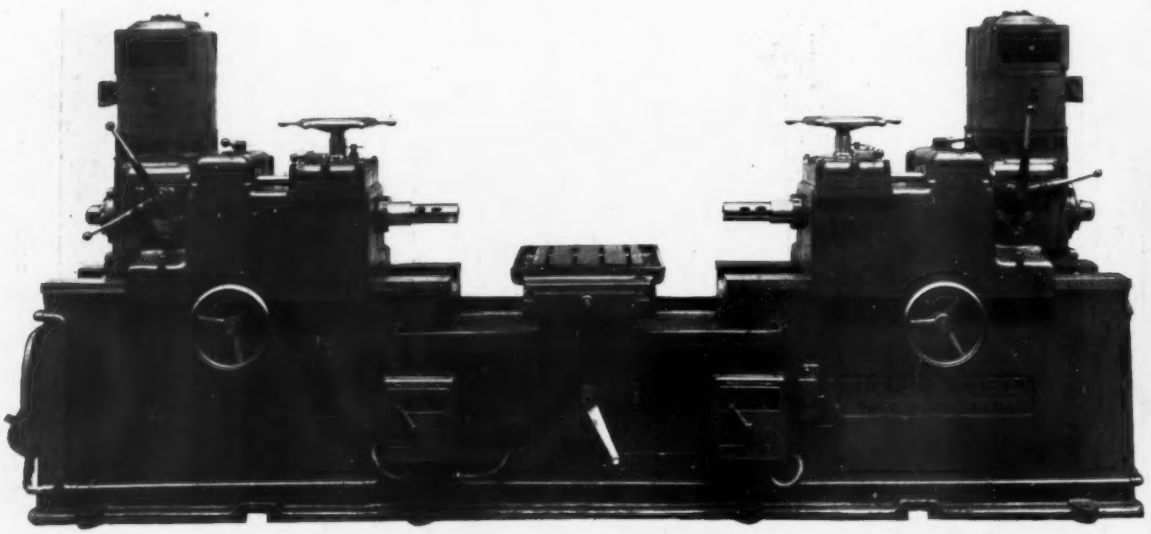
After the trestles had been completed, the outer pairs of stringers were erected and the troughing laid in position. This work was done in block periods, temporary timbers being recessed in the troughs to carry the track pending the spreading of the ballast at a later date. Opportunity was taken to complete the painting, the top of the troughing being coated with a bitumastic solution and the rest of the steelwork receiving coats of red oxide in accordance with standard N.W.R. practice. Finally, after the alignment of the trestles had been checked up, and all bracings riveted, the holding down bolts were grouted in position. As in all bridges on the N.W.R. lead sheet packings $\frac{1}{8}$ in. thick were inserted under all bedplates and under the column bases of the trestles. This material squeezes into any irregularities in the surface of the concrete and makes for even distribution of the load. As the situation of the bridge is such that it is approached from either side by blind curves, two small refuges for the use of platelayers, &c., were erected, one at span No. 3 and one at span No. 7.

On the completion of the work, the temporary staging was dismantled and loaded into trucks, a derrick and Diplory trollies being used. Although a ten-ton travelling hand crane is available on the Kalka-Simla Railway, the cost of using it and the difficulties attendant with its operation on the steep grades, &c., made it quite unsuitable for use at this bridge.

The work was carried out entirely by the staff of the Bridge Department of the N.W.R. Mr. W. A. Anderson, A.M.Inst.C.E., M.I.Struct.E., and Mr A. S. Faruqui being the Executive and Assistant Executive Engineers in charge, whilst the entire scheme was supervised by Mr. W. T. Everall, M.Inst.C.E., Bridge Engineer, N.W.R.

Many of these data and the explanatory plates have been taken from a paper recently read before the Punjab Engineering Congress in Lahore, and the author wishes to thank Mr. Anderson, who presented the paper, and the committee of that Congress for their kind permission to make use of the plates.

A NEW HORIZONTAL DRILLING MACHINE



THE accompanying illustration shows an interesting duplex horizontal drilling machine constructed by Kitchen & Wade Limited, Halifax, for one of the home railways, and fitted with an elevating table. The spindles are exactly opposed, and the table, having elevating and cross traverse motors, enables a wide variety of operations to be done on brackets, links and many other component parts. The bed is a deep box section casting, well ribbed internally and having provision for raising the table. The two heads have adjustment in and out by screw gear, allowing a maximum of 6 ft. 0 in. between spindle noses and a minimum of 2 ft. 0 in. Each head is driven by a 7½-h.p. motor to provide a working capacity of 2¼-in. holes from the solid in hard steel, continuously. Six changes of speed are obtained from the head, *i.e.*, from 360 to 128 r.p.m., and three rates of feed, from 80 to 120 c.p. in. Trip motion with automatic return to the spindles is embodied on each head.

NEW BUFFET CARS, L.M.S.R.

These are handsome and very comfortably appointed vehicles

THE L.M.S.R. has recently placed in service the first of four new buffet cars, the construction of which is being carried out at the company's Derby works. The cars measure 57 ft. in length and are carried on L.M.S.R. standard steel underframes and bogies. The body framing follows, more or less, the company's standard practice, but as the saloon compartment is of considerable length and without cross partitions, the joints between the body pillars and bottom sides are stiffened and not built up to the body walls at the ends. Ample space has been allowed for passengers to stand round the bar without interfering with the freedom of movement of the attendants serving the tables, and this object was also borne in mind when giving the additional width to the corridor outside the kitchen.

The walls of the saloon compartment, as mentioned above, have a completely flush finish, and are veneered with figured white birch relieved with horizontal bands

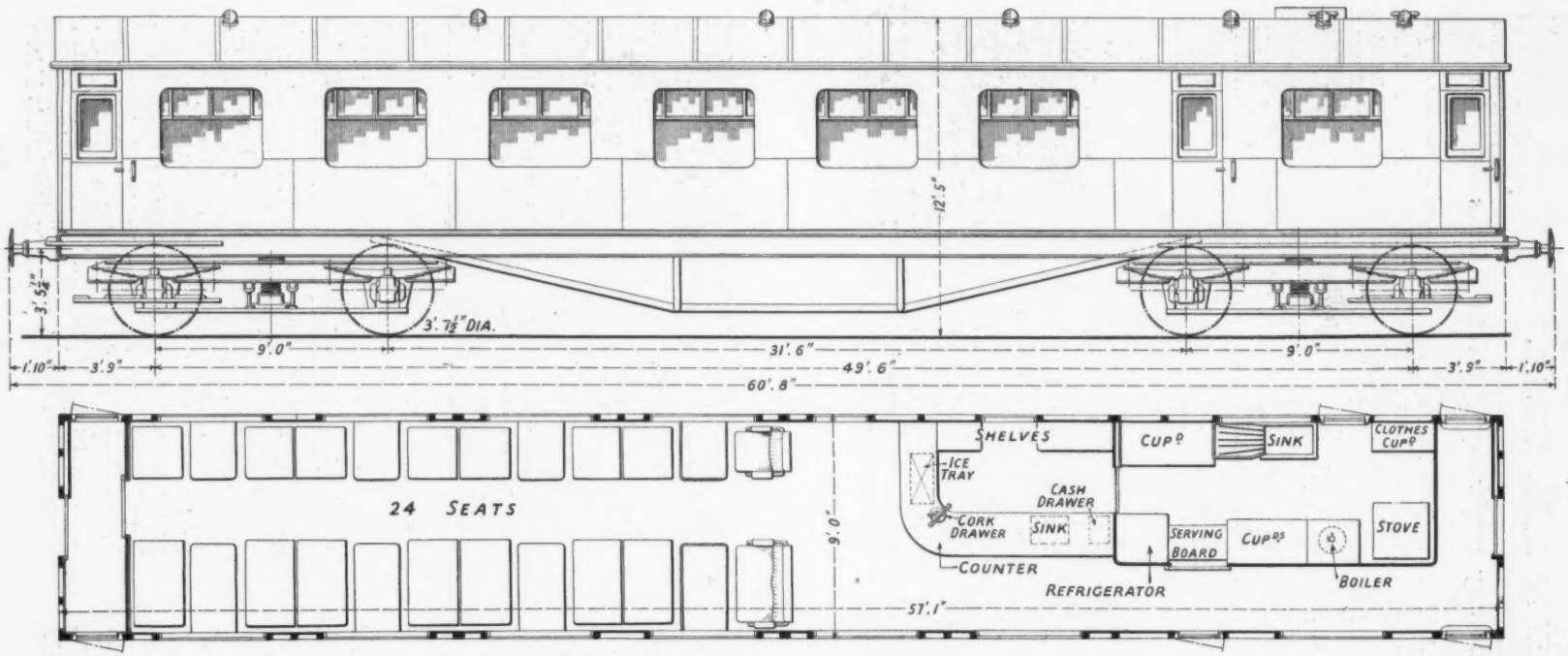
General view of new L.M.S.R. buffet car from both sides

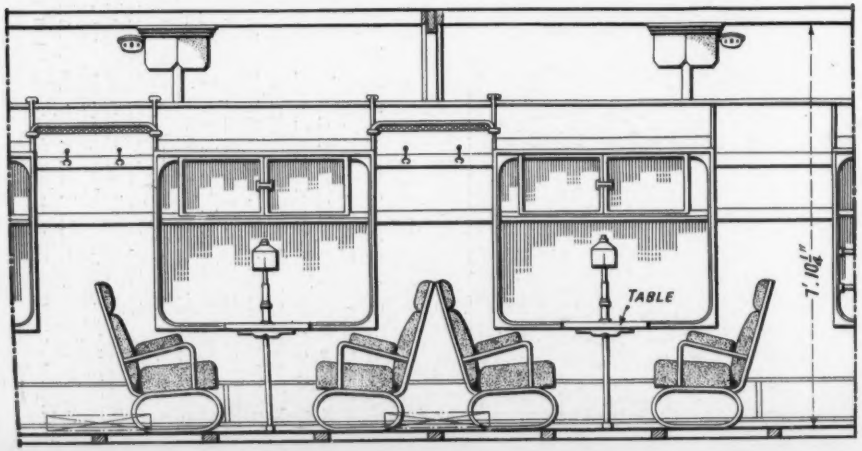
by means of steel brackets, and the deep, reinforced carlines are also strengthened at the joint with the cantrail and body pillars. The galvanised steel body side panels, $\frac{1}{16}$ in. thick, are welded together, thus forming one complete sheet covering the full extent of the body side, and this is then secured to the body framing by screws. The end panels are dealt with in a similar manner.

The galvanised roof panels are fixed to the roof angles and sealed by welding, the metallic arc process being employed. The car is designed to seat 24 passengers in a large open saloon, and incorporates a bar counter at one end, this adjoining and communicating with a kitchen in which light meals can be prepared. The interior of the car has been decorated on very modern lines, the whole effect being one of spaciousness. This is achieved by the perfectly flush interior walls and ceiling, and the chromium plated tubular framed seats, which are low in the back of Australian walnut. The ventilator duct which runs along the floor at the bottom of the side walls is also veneered with Australian walnut to match, whilst the cornice moulding is a light section of stainless iron. Projecting blind boxes have been dispensed with, and roller blinds are housed behind the panel above the quarter light; the finishing panels are secured to the body framing by hidden brackets, thus eliminating visible screw heads.

Interior Appointments

The seats, which are of the double and single armchair type arranged on either side of a centre gangway, are built up on chromium plated tubular steel frames, the cushions, seat backs and armrests being filled with Dunlopillo and covered with terracotta buffalo hide. The small tables between the seats, which are supported on chromium plated tubular steel legs, and the bar counter





Above: Elevation and part sectional plan showing, below, arrangement of seats, bar counter and gangways

Left: Section of car showing seats and tubular framing, Dunlopillo leather covered cushions and backs and other details

NEW BUFFET CARS, L.M.S. RAILWAY, BUILT AT THE COMPANY'S DERBY WORKS

General view of interior with bar counter at far end

Near view of bar counter

Interior of kitchen

top, protected by a stainless iron handrail, are framed up in Australian walnut and inlaid in the centre with Dalex of a shade to match the seat covering. The bar counter and the table tops are finished in a special heat resisting non-staining cellulose. The floor of the open saloon is covered with mottled cork lino, the colours toning with the general finish of the cars.

The counter front, veneered to match the walls of the saloon, is set back in order to give toe-room for people standing at the bar. The under-counter is divided up into sections and fitted with shelves, sink with hot and cold water, ice basket for minerals, &c.; also a refuse bin and cash drawer. The cork drawer is fixed in a convenient position on the top of the counter, and a crown cork opener is fitted underneath the counter, whilst open shelves for the display of tobaccos, cigarettes, confectionery, &c., are provided behind the counter. In order that the stock may be left in the car, hinged shutters are provided to lock up the whole of the bar. A sliding door screened by a curtain leads to the well equipped kitchen, which is lined with stainless iron and fitted with a gas range, and grill, and a Still's pressure boiler for the provision of a constant supply of boiling water. A refrigerator is also provided, whilst ample cupboard accommodation and hinged service shelves across the corridor doorway are available.

Special attention has been given to the ventilation of the kitchen, a Stone's Imperiston fan being specially provided to extract the hot air and fumes from the kitchen ceiling whilst the car is either moving or stationary: a large hatchway and roof ventilators are provided to give additional extraction when the car is moving. The electric lighting is by means of the L.M.S.R. standard Wolverton system, comprising a variable-speed axle-driven generator, a regulator, and a battery of 12 lead-acid cells of 280 ampère-hours capacity. The usual R.C.H. through-control is provided, but the lighting equipment is not connected to this, being immediately under the control of the car staff. Ceiling fittings, each housing two 60-watt, 24-volt pearl lamps, and provided with Nacrolaque panels, furnish the main lighting, which is supplemented by lamp standards attached to the window sills and fitted with a 15-watt pearl lamp and Nacrolaque shade. In the kitchen 60-watt lamps in Benjamin reflectors are used in conjunction with 15-watt lamps for local lighting over sinks, &c.

Heating and Ventilating

The cars are fitted with Stone's pressure ventilating and heating system, which through ducting running at floor level along both sides of the coach, supplies fresh, filtered air uniformly throughout the car. In cool weather the air is heated to a temperature which will maintain a comfortable atmosphere. The coach temperature is automatically controlled by means of a dual compensating thermostat, one arm external to the car and fixed on the underframe, the other in the main air duct. As the temperature of the outside air varies, so the temperature of the air delivered to the car is altered to compensate for the increasing or decreasing heat losses involved.

The ventilating equipment is housed as a single unit on the underframe, and consists of a fan, motor driven from the lighting equipment, a steam operated air heater, and a motor controlled by the compensating thermostat which, through reduction gearing, regulates the quantity of air passing through the heater in accordance with requirements. Horsehair is used as the primary air filter, followed by filters of the viscous oil type. A master thermostat ensures that in cold weather the fan can run only when a steam supply is maintained. In addition to the air heating, supplementary steam heaters are provided to meet any abnormal conditions.

In addition to those already mentioned the following firms have supplied fittings and materials for incorporation in the new cars:—

Article	Firm	Address
Tubular steel frame chairs	Accles & Pollock Limited	Oldbury, Birmingham.
Piping Luxan Grain Vaumol Hide	Connolly Bros. (Curriers) Ltd.	Chalton Street, Euston Road, London, N.W.
Hides	,,	,,
Dunlopillo cushions ..	Dunlop Rubber Co. Ltd.	Cambridge Street, Manchester
,, arm rests	,,	,,
,, back squabs	,,	,,
Kitchen ranges ..	Fletcher Russell & Co. Ltd.,	Warrington
Table tops, &c. ..	Gaskell & Chambers Limited	Birmingham
Gas cylinders ..	Heatley & Gresham Limited	Salford, Lancs.
Cover plates for heaters	G. A. Harvey & Co. (London) Ltd.	Woolwich Road, London, S.E.
Brown velvet, mohair	Lister & Co. Ltd.	Bradford
Lintile linoleum ..	M. Nairn & Co. Ltd.	Kirkcaldy
Stainless iron mouldings	S. Osborn & Co. Ltd.	Sheffield
Table legs, complete with hinges	Pel Limited	Oldbury, Birmingham
Ivorine tablets ..	Reliance (Name Plates) Limited	Twickenham
Steel wire grids ..	Pring & Sons	Sandbach, Cheshire
Gas boilers	W. M. Still & Sons Ltd.	29, Charles Street, E.C.
Heaters	Westinghouse Brake & Signal Co. Ltd.	82, York Road, King's Cross, N.
Ice baskets	Venables Limited	Sandbach
Special glass buffet ..	Pilkington Bros. Ltd.	St. Helens, Lancs.

Ostend-Brussels-Basle international express at Boitsfort, hauled by Belgian National Railways Pacific locomotive No. 109. Note depth of ballast on modern Belgian permanent way

Photo] [J.-A. Van Puyvelde

RAILWAY NEWS SECTION

PERSONAL

At the request of the Ceylon Government, the Secretary of State for the Colonies has appointed a commission to inquire into and report upon the financial position and future policy of the Ceylon Government Railway. The Chairman of the commission is Brig.-Gen. F. D. Hammond, and the Member and Secretary are, respectively, Mr. J. D. C. Couper and Mr. J. F. M. Taylor: they have gone overland to Marseilles and sail from there for Ceylon today. (*See also page* 463.)

We are sorry to learn of the serious assault upon Mr. D. H. Elias, General Manager of the Federated Malay States Railways, in which he was stabbed in the neck by an Indian clerk. Latest reports to the Colonial Office indicate that, though his condition is still serious, he is going on as well as can be expected.

From the *London Gazette* of September 11:—Territorial Army: Royal Engineers; Engineer and Railway Staff Corps.—Col. Sir Cyril R. S. Kirkpatrick, Kt., T.D., M.Inst.C.E., resigns his commission, but retains his rank, with permission to wear the prescribed uniform (September 5). Sir Cyril was sometime Chief Engineer, Port of London Authority, and President of the Institution of Civil Engineers.

We regret to record the death, on September 14, of Colonel John Gibson Fleming C.B.E., D.S.O., late R.E., fourth Crown Agent for the Colonies, aged 56. Educated at Haileybury and the Royal Military Academy, Col. Fleming received his commission in the Royal Engineers in 1898, and saw service in the South African war. In the great war he was awarded the D.S.O. and Brevet Lieutenant-Colonelcy in 1916, the C.B.E. in 1919, and in 1924 he retired with the rank of Colonel. It was in 1932 that Col. Fleming was appointed fourth Crown Agent and Engineer-in-Chief in succession to Lt.-Col. Sir James Carmichael.

Mr. H. G. Cabrett, Chairman of the Local Board, Córdoba Central Railway, returned to Buenos Aires on July 28, after an extensive tour through the United States, Canada, the Far East, and Europe.

The Canadian Government announced, on September 11, the appointment of Mr. S. J. Hungerford, as Chairman of the new Canadian National Railways board of directors. The following have also been appointed as members of that body: Mr. J. Y. Murdoch, K.C., Mr. Wilfred Gaynon, Mr. Herbert J. Symington, Mr. Donald H. McDougall and Mr. Robert J. Moffatt. Mr. Hungerford continues, in addition, to be President of the system, the post in which he was confirmed early in 1934.

Mr. S. J. Hungerford,
Appointed Chairman of the new Canadian National Railways board of directors

Born near Bedford, Quebec, in July, 1872, Mr. Hungerford entered railway service in May, 1886, as an apprentice on the South Eastern Railway, now a part of the Canadian Pacific system. Between 1891 and 1910 he held various positions with the Canadian Pacific Railway, including those of Master Mechanic of the Western Division, headquarters at Calgary, and Superintendent of the large locomotive and other shops at Winnipeg. He accepted the position of Superintendent of Rolling Stock, Canadian Northern Railway in 1910, with headquarters first at Winnipeg and later at Toronto. In 1917 Mr. Hungerford became General Manager of Eastern Lines, C.N.R.; in 1918 he was appointed Assistant Vice-President of Operation, Maintenance and Construction; and in 1920 he was promoted to vice-presidential rank with the Canadian National Railways. When that system absorbed the Grand Trunk lines, he became Vice-President in charge of operation, maintenance and construction in February, 1923, the position he held until the resignation of Sir Henry Thornton in 1932, when he was appointed Acting President. He was also elected President of the Central Vermont Railway in that year, and was confirmed as President of the C.N.R. trustee board in 1934. With the recent replacement of this board by the new directorate, Mr. Hungerford becomes Chairman of the latter as well as President.

Indian Railway Staff Changes

Mr. W. C. Morley, Auditor of the Bengal Dooars Railway Co. Ltd. has resigned.

Mr. W. E. Gurney has been appointed to officiate as Deputy Chief Engineer, Bridges, G.I.P.R., as from July 11.

Mr. A. C. Robertson, Superintendent, Mechanical Engineering & Transportation (Power) Departments, E.I.R., retired from Government service on July 21.

Mr. G. G. T. Toller, O.B.E., V.D., Deputy Chief Engineer, Burma Railways, has been granted 7½ months' leave as from July 6.

Mr. S. E. L. West, O.B.E., V.D., officiating Divisional Superintendent, N.W.R., has been granted eight months' leave, as from August 30.

Mr. N. Ridley, whose retirement from the position of L.N.E.R. Advertising Manager's Scottish Area Representative—announced in our issue of August 14—took effect on September 9, had 44 years' service with the former North British Railway, and with the L.N.E.R. He joined the N.B.R. at Balloch in 1892 and afterwards went to Alloa and Queen Street, Glasgow. From 1895 to 1900 he was attached to the office of the Superintendent of the Line at Edinburgh as relief and special ticket examiner, and from 1900 to 1906 as inspector for the supervising of the en-

forcement of the excess luggage regulations, and for other special work including the speeding up of goods and express passenger trains. Each of these duties took him to every part of the North British line, and so Mr. Ridley acquired a thorough knowledge of the whole system. From 1907 to 1916 he had charge of the section in the Superintendent of the Line's office controlling the distribution of all passenger rolling stock, also the marshalling of all special and relief trains in Edinburgh and the Eastern District. This included the early part of the war period, when the mobilisation and subsequent movements of troops and equipment placed a heavy responsibility on the section. From 1917 to 1922 he had charge of the Advertising Section under the Commercial Superintendent of the N.B.R.

Mr. N. Ridley,

Advertising Manager's Scottish Area Representative, L.N.E.R., 1923-36

At the amalgamation in 1923, the L.N.E.R. placed its advertising arrangements for the whole line under an Advertising Manager with headquarters in London, and Mr. Ridley was then attached to that office, and appointed as Area Advertising Representative in charge of all L.N.E.R. traffic advertising in Scotland, a position he continued to occupy until he retired. (See also paragraph below.)

Mr. James B. Dunlop, who, as announced in THE RAILWAY GAZETTE of August 14, has succeeded Mr. N. Ridley as L.N.E.R. Advertising Manager's Scottish Area Representative, comes of a Midlothian family, but began his railway career with the Great Eastern Railway at Liverpool Street station, London, in 1907. During the war he served with the 1st Battalion of the London Scottish in France and Belgium, and on returning to the railway was posted to the publicity section. On the amalgamation of the railways in 1923, Mr. Dunlop was appointed to a position in the head office of the Advertising Manager of the L.N.E.R. in London, and in the same year he was transferred as Assistant to the Scottish Area Advertising Representative.

Mr. A. J. Lee, whose retirement from the position of Assistant Chief Mechani-

Mr. A. J. Lee,

Appointed Administrative Chief of the Mechanical Department, Great Western of Brazil Railway

Mr. R. H. Dobson,

Appointed Traffic Manager, Great Western of Brazil Railway

cal Engineer, Entre Rios and Argentine North Eastern Railways was announced in our issue of July 24, has been appointed Administrative Chief of the Mechanical Department of the Great Western of Brazil Railway. In addition to the details of his career mentioned in that issue, it may be noted that he was born in 1890, and received a commission in the Indian Army Reserve of Officers during the war, from which his services were loaned to the Indian Munitions Board. In January, 1924, he joined the Buenos Ayres & Pacific Railway, and in May of that year was appointed Works Manager, Argentine North Eastern Railway, prior to his assuming charge of the Mechanical Department of that railway. It was in 1930 that Mr. Lee was appointed Assistant C.M.E. of the Entre Rios and Argentine North Eastern Railways, his last appointment prior to accepting his new post in Brazil.

Mr. R. H. Dobson, who, as announced in THE RAILWAY GAZETTE of July 3, has been appointed Traffic Manager, Great Western of Brazil Railway, was born at Middleton-in-Teesdale in 1903. He entered the service of the L.N.E.R., and was first

Mr. J. B. Dunlop,

Appointed Advertising Manager's Scottish Area Representative, L.N.E.R.

posted to the Middlesbrough train control office, thereafter gaining experience in the Goods Commercial Department at various stations and offices in the Middlesbrough District. In December, 1929, he was appointed as an Assistant in the Traffic Department of the Great Western of Brazil Railway, and was promoted to be Assistant Traffic Manager in January, 1931, the position he vacated on June 1, to become Traffic Manager. Mr. Dobson passed the graduateship examination in 1927, and the asscciate membership examination of the Institute of Transport, with distinction in "Rights and Duties of Transport Undertakings." He is a Fellow of the Royal Statistical Society as well as an Associate Member of the Institute of Transport.

Mr. Ridley, whose portrait and biography appear above, was the recipient of many warm tributes, when Mr. Dandridge, Advertising Manager, London & North Eastern Railway, made a presentation to him on behalf

of his staff and colleagues in other departments, at Waverley station, Edinburgh, on September 14. Mr. Ridley suitably thanked those who had contributed towards the present.

Mr. C. W. Bayne, C.B.E., General Manager of the Leopoldina Railway (Brazil), acting upon medical advice, has resigned; and Mr. G. B. F. Neele, Assistant General Manager, has been appointed to succeed him as General Manager.

M. Rottet, Chairman of the Moscow Underground Railway, is at present on a visit to London.

Miss Audrey Shirtliff has been appointed special Saleswoman to the Great Western Railway, to keep in touch with women's organisations and with works and factories where women are employed. (See editorial note on page 437.)

Mr. G. Gibb has been appointed representative in Scotland for Westinghouse Brake & Signal Company metal rectifiers. He took up his new duties on September 14, at 11, Bothwell Street, Glasgow C.1, the offices of J. E. Robson & Company, for many years the Westinghouse representative for brakes and heating apparatus.

Mr. Alexander Spencer, Chairman of George Spencer Moulton & Co. Ltd., the General Railway Signal Co. Ltd., and the Superheater Co. Ltd.; a Director of the Metropolitan-Cammell Carriage & Wagon Co. Ltd. and of other concerns —whose death we announced in our issue of June 19—left estate valued at £53,292 (£40,082 net).

We regret to announce the death on September 13, in Glasgow, of Mr. Adam C. Hay, who for many years was Managing Director of R. & J. Dick Limited, Belting Manufacturers, of that city. Mr. Hay was connected with the company for upwards of 58 years, being for some years Manager of the Belting Department, and later a partner in the firm. When the company was floated in 1908, he became a Director, and was subsequently elected Managing Director.

Mr. Ernest Blackstone and Mr. Harold Blackstone have retired from the board of Blackstone & Co. Ltd., of Stamford, Lincolnshire. The board will continue, however, to have the benefit of their services, as they have both agreed to act in an advisory capacity. In addition to this retention of the family connection with the firm, three members of the third generation of the family are also actively associated with it in executive positions. The changes in the directorate follow the co-operative arrangement of the firm made some six months ago, with R. A. Lister & Co. Ltd., of Dursley, Gloucestershire.

Proposed Renewal of "A" Licences

Opposition by Railway Companies

At the Metropolitan Licensing Authority's Court at Romney House, on September 14 and 15, Mr. Gleeson Robinson, Traffic Commissioner for the Metropolitan Area and Licensing Authority for the London Traffic Area, heard an application by Bouts-Tillotson Transport Limited, London, for a renewal of its A licence in respect of 139 vehicles and 56 trailers. This was the first large road operator to seek renewal of the licence granted two years ago when the Road and Rail Traffic Act of 1933 came into operation. The application was opposed by the four main line railway companies. The case for the applicants was opened on Monday and continued on Tuesday. Mr. Gerald Hall, Transport Manager of Roneo Limited, giving evidence on Tuesday in support of the application, said that the main reason his firm used the road service was that it could get much quicker delivery. There was also a lower percentage of damage than by rail. If goods were sent off to Manchester by road at 4 p.m., they would be delivered to customers before noon the next day. For consignments by rail the average was about three days. That was his experience.

In cross-examination by Mr. Maxwell Fyfe, K.C., for the railway companies, Mr. Hall said that he had not got any specific instances in the past three years of goods sent by rail to Manchester which took three days to deliver, but he would endeavour to produce them. He could not recall any complaints as to treatment of furniture sent in railway containers. There were many more claims for damage by rail than by road, but he had no idea of their number. He got that impression from the numerous claims handled. He sent 25 per cent. of his traffic by rail and 75 per cent. by road. Where the destination was served by one of the road operators his firm usually employed, it sent by road. To Bristol most of his goods went by rail.

Mr. W. G. Smith, despatch manager for the British Oxygen Co. Ltd., said that before going to the applicants, his firm did to a large extent use its own road vehicles or rail passenger services. It was the urgency for quick delivery which decided the firm to use road transport. It would be a serious thing for his firm if by reduction of vehicles or the abolition of the licence it could not obtain the necessary transport.

Mr. B. D. Baverstock, Traffic Adviser, Stephens Inks, said that his firm started depots in various parts of the country and the railway companies were approached for rates, but the rates offered would not enable his firm to maintain depots. He found road transport satisfactory, but he still sent about 40 per cent. of his traffic by rail, and used the railway when it gave a good service. He supported the renewal of the present licence.

Mr. Maxwell Fyfe, K.C. (Mr. A. Tylor with him), outlined the case which he intended to present to the tribunal on behalf of the railway companies. He submitted that, if it were established that existing transport services, apart from those to be provided by the applicants, were sufficient, the licence ought not to be granted, and all the more so as much of the traffic abstracted from the railway companies had been built up on uneconomic rates.

Mr. Ashton Davies, Chief Commercial Manager, L.M.S.R., giving evidence on behalf of the four companies, showed that the total tonnage of general merchandise in Classes 7 to 21 carried by the British railways had fallen from 60,242,571 in 1927 to 45,313,801 in 1935. The percentage reductions for the different companies were:—L.M.S.R. 24, L.N.E.R. 30, Great Western 18, and Southern 26. General merchandise represented 43 per cent. of the tonnage carried by the railways, but revenue from general merchandise represented 75 per cent. of the total revenue from goods traffic. The inference which he drew from these figures was that the railways were being under-utilised. Coal traffic tonnage on the Southern Railway had increased between 1927 and 1935 because of the development of Kent coal.

According to the Board of Trade index of production there had been an increase of 16·9 per cent. in production, excluding mines and quarries, between 1930 and 1935. During that period the merchandise tonnage of the railway companies had fallen by 7,912,000 tons, which showed that they had not had their share of the increased prosperity. The railway companies had been careful to keep up the standard of efficiency of service, and were always attuning their arrangements to industrial needs. Apart from improving wagons, carriages, and locomotives they had spent about £51,000,000 on capital improvements during the last twelve years. The speed of goods trains had been improved by the use of vacuum-fitted stock; and collection and delivery services were being extended all over the country. Road transport certainly had a function, and was a great convenience for short distances, but for trunk services the railways were best. For special consignments the railways were always ready to make special arrangements for forwarding at later than the usual hours. By selecting the traffics which could afford to pay higher charges the road hauliers were disturbing the railway rate structure and tending to throw an unfair burden of costs on the industries which were least able to bear it.

The hearing was adjourned until September 28.

XUM

Opening of the Johannesburg Exhibition

At the invitation of the High Commissioner for the Union of South Africa in London, we were present at the pleasant ceremony at South Africa House on September 15, when the speeches made at Johannesburg at the opening of the Empire Exhibition were relayed. Among those present were the following:—

The Earl of Athlone, former Governor-General of South Africa; Mr. Malcolm MacDonald, Secretary of State for the Dominions; Lord Riverdale, Chairman of the London Committee of the Exhibition; and Maj.-Gen. Sir Fabian Ware.

After an informal buffet luncheon, the guests proceeded to the excellent cinema theatre in the building, and at 2 p.m. heard Lord Clarendon, Governor-General of South Africa, reading the message sent to him by the King. Lord Clarendon then paid a warm tribute to the early settlers, the enterprise of the Union and the organisers of the exhibition. He also welcomed the representatives of neighbouring territories and hoped that their visit would consolidate their mutual interests and the trade relations between them and the Union. General Herzog, Prime Minister of the Union, and Mr. G. M. Huggins, Prime Minister of Southern Rhodesia, also spoke. The broadcasts concluded with the greetings from the Prime Ministers of Great Britain, Canada, Australia and New Zealand.

In closing the ceremony, Mr. C. te Water, the High Commissioner, called attention to the intimate trade relations between the Union and the U.K., and forecast their even greater improvement as a result of the exhibition. He also expressed great appreciation of the work of Lord Riverdale and his committee in the London organisation of the exhibition. (It may be recalled that we dealt with the exhibition and its various exhibits in our issues of July 17, August 7, and August 21.)

The Technical Section of the "Verein"

The Technical Section of the Central European Railway Association held its general meeting this year in May at Innsbruck, on the invitation of the Austrian Federal Railways, under the Presidency of Mr. Von Láner of the Hungarian State Railways. It is interesting to note that the Hungarian administration has been at the head of this section of the association, the history of which was given in our issue for June 16, 1933, for 54 years, and the Innsbruck meeting unanimously voted that it continue in that capacity.

The section has 6 committees, dealing with technical working, civil engineering, locomotives, rolling stock, inter-running of the latter, and electrical apparatus. Among the subjects now being dealt with are inductive interference with low voltage circuits; disturbance of wireless apparatus near the line welding; handling of exceptional loads; coupling gear; wear and tear on tyres; transition curves and the treatment of reverse curves; rail joints and their possible elimination; nomenclature for locomotive and rolling stock classification; economical methods of track maintenance and renewal; and point and crossing design. The editorial committee of the *Organ für die Fortschritte des Eisenbahnwesens*, the association's technical journal, has been enlarged. The Danish State Railways have invited the section to meet at Copenhagen in 1937.

The New Channel Train Ferries

On October 14–15 the new through sleeping car services between London and Paris will begin, leaving Victoria at 10 p.m. and Paris at 9.50 p.m., and arriving respectively at the Gare du Nord and Victoria at 8.55 a.m. and 8.30 a.m. The sleeping cars will be carried by train ferry between Dover and Dunkirk, and it is hoped to arrange for customs and passport examination on the trains. There will also be day services by the train ferries, beginning on October 15, in each direction, leaving Dover and Dunkirk respectively at 1.15 p.m. and 2.15 p.m., and arriving at the opposite ports at 5 p.m. and 6.20 p.m. respectively. The 11 a.m. boat train from Victoria will connect with the outward ferry, and the inward arrival at Victoria will be at 8.40 p.m. From October 3–4 until the through trains begin on October 14–15 the train ferry boats will ply nightly between Dover and Dunkirk, and the present Folkestone–Dunkirk service by the French A.L.A. boats will cease.

"AGENORIA" LOCOMOTIVE AT YORK RAILWAY MUSEUM.—By courtesy of the Director of the South Kensington Science Museum, the locomotive *Agenoria* has been loaned to the Railway Museum at York. The *Agenoria* was built in 1829 by Messrs. Foster Rastrick & Co., of Stourbridge, one of the partners of the firm being John Urpeth Rastrick, who was born at Morpeth. The locomotive was first used on the opening of the Shutt End Colliery Railway at Kingswinford, Staffordshire, on June 2, 1829, and afterwards worked on that railway for more than 35 years. It is almost identical with the *Stourbridge Lion*, built by Foster, Rastrick & Co. in 1828 and sent to America, where it was the first locomotive to run upon rails in that continent. The *Agenoria* weighs six tons and carries a chimney 20 ft. long, which was so constructed to ensure the maintenance of sufficient draught to the boiler for steam-raising purposes.

RAILWAY AND OTHER REPORTS

Trust of British Transport.—An initial half-yearly interim distribution is announced at the rate of £3 11s. 11d. per cent. per annum.

Barsi Light Railway.—The directors have decided to recommend at the forthcoming general meeting the payment of a final dividend on the ordinary stock of 2½ per cent. actual, making, with the interim distribution in May last, a total distribution of 4½ per cent. for the year to March 31, 1936.

United Steel Companies Limited.—The directors recommend a final dividend on the 6,616,365 shares of £1, fully paid and converted into stock, of 5 per cent., less tax. This compares with 4½ per cent. last year. With the interim dividend of 2½ per cent. already paid, the total distribution is thus 7½ per cent. for the year ended June 30 last, as against 7 per cent. for the previous twelve months and 5½ per cent. for 1933–34.

Samana & Santiago Railway.—Gross receipts for the year 1935 were £29,207, compared with £28,413 in 1934, and expenditure was £25,273, against £25,300, bringing the operating ratio down from 89·04 per cent. to 86·53 per cent. A credit balance of £3,933 (compared with £3,113) is carried from revenue to net revenue, and the debit balance to be carried forward has been reduced from £23,202 to £21,425. Cocoa is still the principal traffic, forming about 70 per cent. of the goods traffic receipts in 1935, and showing an increase of nearly 28 per cent. compared with the previous year, and this in spite of severe road motor competition. Total merchandise receipts in 1935 amounted to £21,052, against £21,024 in 1934. The arrangement made in 1934 by which the Government in Santo Domingo took over the collection of wharf charges, is now working satisfactorily.

North Central Wagon Co. Ltd.—The report for the year ended June 30 last shows a profit of £44,216, as against £42,286. Adding £6,093 brought in, makes a disposable balance of £50,309. After meeting preference requirements for the year, and paying an interim dividend of 6 per cent. on the ordinary shares, the directors recommend a final dividend of 9 per cent., making the total distribution for the year 15 per cent., less tax, the same as for the previous year. The sum of £8,000 (against £10,000) is placed to reserve, leaving £7,152 to be carried forward. In December, 1935, the company acquired substantially the whole of the ordinary share capital of the Lincoln Wagon & Engine Co. Ltd. for cash. It also has a substantial interest in Wagon Repairs Limited.

NOTES AND NEWS

New L.M.S.R. Dredger for Fleetwood.—The new L.M.S.R. dredger *Fylde*, for service at Fleetwood Harbour, was launched at Renfrew on Wednesday from the yard of the builders, Wm. Simons & Co.

Freight Conference in Moscow.—The fourth European-Asiatic Railway Conference on Freight Traffic was opened in Moscow on Wednesday, to discuss conditions of transport, charges, and other problems of carriage and costs. Representatives are attending from Japan, Manchukuo, Germany, Lithuania, and Poland.

G.W.R. Passenger Service Withdrawn.—The G.W.R. line between Swansea East Dock and Neath Riverside will be closed to passenger traffic as from Monday, September 28. The following intermediate stations will be affected: Danygraig Halt, Briton Ferry Road, Cardonnel Halt, and Neath Abbey. Goods traffic will continue to be dealt with.

Railcars for Dense Traffic in French Indo-China.—Following the success of the railcars of the Yunnan Railway in recapturing traffic from the road between Hanoi and Haiphong, the State Railways of Indo-China are to purchase half-a-dozen diesel cars to operate fast suburban services out of Hanoi and Saigon and for providing rapid and frequent services between Saigon and Mytho.

The Ceylon Railway Commission.—The terms of reference of the Ceylon Railway Commission, over which Brig.-Gen. Hammond is presiding—as referred to on page 459—include an enquiry as to whether the railway should be permitted to run road and air services, and if so, to what extent these should be limited. The commission will also enquire, from the technical standpoint, into methods of general operation and make recommendations for their improvement, as well as for the reduction or elimination of the present financial drain upon the resources of the colony. The enquiry is expected to occupy about 10 weeks.

Railway Assessment Authority.—The recently-issued report of the Railway Assessment Authority for the year ended March 31, 1936, deals mainly with the recent litigation with regard to the net annual value of the undertaking of the Southern Railway and to the question of the separate assessment of let-out properties on that system, and, in particular, with the general principles laid down by the House of Lords for the ascertainment of the net annual value of a railway undertaking. The report also refers to the valuation of the undertaking of the London Passenger Transport Board, other than the omnibus parts. This will involve the valuation of properties at present assessed at about £940,000 net annual value and comprising *inter alia*, 190 miles of railway, 205 railway stations, and 345 miles of tramway and trolleybus routes.

Rubber-tyred Railcar on L.M.S.R.—The 56-seater rubber-tyred Coventry-Michelin railcar, described in our issue of June 19, is now running experimentally in public passenger service on the L.M.S.R. between Rugby, Leamington Spa, Coventry, and Nuneaton. It is providing additional facilities in this area, and will continue to do so until October 2, or possibly later.

Underground Proposal for Cincinnati.—The city of Cincinnati and the Federal Government recently co-operated in a survey of the city's transportation problem, and as a result an electric subway is being proposed to relieve congestion in the streets. More than ten years ago the building of a subway was begun, but the work was stopped. The new project proposes to make use of part of the abandoned works in the construction of a 2½-mile rectangular subway in the centre of the city. The cost is estimated at $6,000,000.

Higher Speed Limit in France.—After extensive trials, the Nord has been permitted to run its express trains up to 130 km.p.h. (81 m.p.h.) between Creil and Arras, a section of line equipped with automatic block signals. This is the first time regular steam trains have been allowed to run at this speed in France, although the electric locomotives of the P.O.-Midi have been permitted to run at this speed between Orleans and Tours since May last. A speed of 125 km.p.h. (78 m.p.h.) is being authorised for steam locomotives over certain sections of the Est.

Railway Owned Omnibus Services.—The monthly meetings of the Railway Club were reopened on September 10, when members assembled at the Royal Scottish Corporation Hall, Fetter Lane, E.C.4, to hear an authoritative and instructive paper by Mr. Charles E. Lee, Assistant Editor of THE RAILWAY GAZETTE, on "Railway Owned Omnibus Services." Mr. Lee illustrated his paper with lantern slides, many of them of great historical value, and traced the development of railway buses from those connecting with the Liverpool & Manchester trains in 1831, up to the routes operated by the companies until a few years ago.

Anglo-Scottish Railway Assessment Authority.—The sixth annual report of this authority covers its proceedings during the year ended March 31, 1936. The authority has continued the consideration of the ascertainment and apportionment of the average net receipts of the two Anglo-Scottish railway companies (L.M.S.R. and L.N.E.R.) for the five years from 1930 to 1934 inclusive. Agreement has been reached with the railway companies as to the proportion of the total charge to revenue in respect of maintenance and renewal of wagons which might be taken as being fairly applicable in Scotland.

Dublin-London Air Service.—A new daily air service was inaugurated between Dublin (Baldonnel), Bristol (Whitchurch), and London (Croydon) on Monday last, September 14. The service is being operated jointly by Blackpool & West Coast Air Services and Aer Lingus Teoranta. The journey time is three hours, and the fares between London and Dublin are £5 17s. 6d. single and £11 return.

L.M.S. Properties at Auction.—An auction of freeholds and leaseholds belonging to the London Midland & Scottish Railway Company in and near London is announced to take place at the Mart on October 15. The properties include shops in High Holborn and Knightsbridge, and houses and shops in Kentish Town and Camden Town, as well as large freehold sites at Dagenham, Hornchurch, Upminster, and Stonebridge Park.

Chilean Northern Railway.—A meeting of holders of the £1,348,860 five per cent. first mortgage debentures of the Chilean Northern Railway Company is convened for October 7 to consider an offer by the Chilean Government. Debenture holders are asked to agree to a scheme which provides that as from July 1, 1931, the debentures will cease to be fixed interest bearing and will be entitled to receive an amount equal to the interest paid on an equal nominal sum of Government "creditos."

New Maritime Station at St. Malo.—On August 2 the new Maritime station was opened at St. Malo by the French Minister of Marine, in the presence of Mr. E. J. Missenden, Docks and Marine Manager; Mr. S. Newcombe, Divisional Marine Manager; Mr. C. Cooper, Continental Assistant to the Traffic Manager; Mr. A. de Veulle, the St. Malo Agent; and Mr. W. H. Pape, of the Advertising Department; all of the Southern Railway. The new station contains the Southern Railway offices, removed from the Rue des Courdiers, which have now been closed.

L.N.E.R. Posters.—Posters advertising L.N.E.R. race excursions are now being headed by a pictorial design, printed in 12 colours, showing a scene on Doncaster racecourse one hundred years ago. It is the work of Miss Doris Zinkeisen, who has given a lively impression of a race in progress, with racegoers, gypsies, and jockeys in the foreground. The size is such as to allow ample space for setting out details of train arrangements and fares below, and the example we have before us, which deals with the forthcoming autumn meeting at Newmarket, is a most attractive combination of pictorial advertising and well displayed travel information. The L.N.E.R. also sends a coloured poster by Miss Anna Zinkeisen designed to attract visitors to Lincoln. The artist has chosen a mediæval

jousting scene, gaily coloured and full of interest in the foreground figures. A knight in the centre is receiving a favour from his lady with a rather smaller display of enthusiasm than we should care to risk ourselves, while in the background, behind the gallery of distinguished spectators, rise the towers of Lincoln cathedral.

South African Transport Conference.—This conference, which was attended by representatives of 15 African territories, and was opened by the Governor-General of the Union of South Africa, Lord Clarendon, on September 7, has now closed. Among the subjects discussed were the acceleration of South African railway services. At the invitation of Lourenço Marques the next conference will be held there.

L.M.S.R. Golf Tournament.—There was a record entry this year for the fifth L.M.S.R. "L. F. Rowlandson Cup" championship, which is open to all grades of the company's staff. Twenty-four finalists met last Saturday at the Hillside Golf Club, Southport, of which Mr. Rowlandson, the donor of the cup, is Chairman, and the cup and replica were won by Mr. T. E. Hawkins, of Liverpool. The second prize went to Mr. P. Dutton, of Manchester, and the third to Mr. A. Wallace, of Troon, who won the same prize in last year's competition. Mrs. Rowlandson presented the prizes. The donor, Mr. L. F. Rowlandson, is Superintendent of Organisation and Staff, L.M.S.R.

Road Accidents.—The Ministry of Transport return for the week ended September 12 of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding period of last year :—

	Killed, including deaths resulting from previous accidents		Injured	
England ...	116	(127)	4,297	(4,347)
Wales	4	(8)	196	(197)
Scotland ...	12	(18)	450	(397)
	132	(153)	4,943	(4,941)

The total fatalities for the previous week were 119, compared with 147 for the corresponding period of last year.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 37th Week			Totals to Date		
	1936	1935	Inc. or Dec.	1936	1935	Inc. or Dec.
L.M.S.R. (6,916¾ mls.)	£	£	£	£	£	£
Passenger-train traffic...	538,000	522,000	+ 16,000	18,843,000	18,532,000	+ 311,000
Merchandise, &c. ...	493,000	467,000	+ 26,000	17,371,000	16,396,000	+ 975,000
Coal and coke ...	224,000	219,000	+ 5,000	8,782,000	8,353,000	+ 429,000
Goods-train traffic ...	717,000	686,000	+ 31,000	26,153,000	24,749,000	+ 1,404,000
Total receipts	1,255,000	1,208,000	+ 47,000	44,996,000	43,281,000	+ 1,715,000
L.N.E.R. (6,332 mls.)						
Passenger-train traffic...	363,000	348,000	+ 15,000	12,256,000	12,062,000	+ 194,000
Merchandise, &c. ...	320,000	303,000	+ 17,000	11,792,000	11,326,000	+ 466,000
Coal and coke ...	212,000	209,000	+ 3,000	8,475,000	8,056,000	+ 419,000
Goods-train traffic ...	532,000	512,000	+ 20,000	20,267,000	19,382,000	+ 885,000
Total receipts	895,000	860,000	+ 35,000	32,523,000	31,444,000	+ 1,079,00
G.W.R. (3,746½ mls.)						
Passenger-train traffic...	236,000	230,000	+ 6,000	7,965,000	7,886,000	+ 79,000
Merchandise, &c. ...	198,000	195,000	+ 3,000	6,933,000	6,647,000	+ 286,000
Coal and coke ...	100,000	96,000	+ 4,000	3,681,000	3,609,000	+ 72,000
Goods-train traffic ...	298,000	291,000	+ 7,000	10,614,000	10,256,000	+ 358,000
Total receipts	534,000	521,000	+ 13,000	18,579,000	18,142,000	+ 437,000
S.R. (2,153 mls.)						
Passenger-train traffic...	353,000	339,000	+ 14,000	11,664,000	11,522,000	+ 142,000
Merchandise, &c. ...	66,000	64,500	+ 1,500	2,287,000	2,260,000	+ 27,000
Coal and coke ...	28,000	28,500	− 500	1,136,000	1,078,000	+ 58,000
Goods-train traffic ...	94,000	93,000	+ 1,000	3,423,000	3,338,000	+ 85,000
Total receipts	447,000	432,000	+ 15,000	15,087,000	14,860,000	+ 227,000
Liverpool Overhead ... (6½ mls.)	1,264	1,228	+ 36	44,478	44,362	+ 116
Mersey (4½ mls.) ...	4,015	3,966	+ 49	148,562	147,432	+ 1,130
*London Passenger Transport Board	558,200	544,400	+ 13,800	6,092,100	5,909,400	+ 182,700
IRELAND						
Belfast & C.D. pass. (80 mls.)	3,376	3,356	+ 20	100,589	99,685	+ 904
,, ,, goods	368	516	− 148	19,922	18,409	+ 1,513
,, ,, total	3,744	3,872	− 128	120,511	118,094	+ 2,417
†Great Northern pass. (543 mls.)	13,850	12,300	+ 1,550	403,850	388,650	+ 15,200
,, ,, goods	9,950	10,200	− 250	342,200	333,250	+ 8,950
,, ,, total	23,800	22,500	+ 1,300	746,050	721,900	+ 24,150
†Great Southern pass. (2,067 mls.)	47,414	41,157	+ 6,257	1,341,333	1,314,464	+ 26,869
,, ,, goods	42,602	42,749	− 147	1,464,889	1,362,206	+ 102,683
,, ,, total	90,016	83,906	+ 6,110	2,806,222	2,676,670	+ 129,552

* 11th week. † 36th week.

British and Irish Railways Stocks and Shares

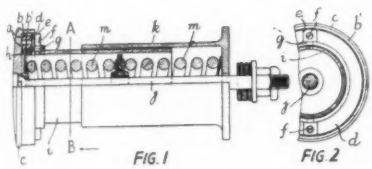
Stocks	Highest 1935	Lowest 1935	Prices Sept. 16, 1936	Rise/Fall
G.W.R.				
Cons. Ord. ...	55½	44½	55	+3
5% Con. Prefce. ...	124	108	120½	—
5% Red.Pref.(1950)	117	106¾	109½	—
4% Deb.	118½	108	115½	—
4½% Deb.... ...	122	110	117½	—
4½ Deb.	129½	118	125	—
5% Deb.	140¼	130	136½	—
2½% Deb.... ...	82¼	68½	76	—
5% Rt. Charge ...	137	128	134½	—
5% Cons. Guar. ...	136¾	120½	131	—
L.M.S.R.				
Ord.	25 5/16	16	27½	−½
4% Prefce. (1923)	58¼	43½	77½	—
4% Prefce. ...	87½	73½	87½	—
5% Red.Pref.(1955)	107	97¾	106½	−½
4% Deb.	110¼	99½	107½	—
5% Red.Deb.(1952)	119 11/16	111 1/16	116½	−½
4% Guar. ...	105⅝	95½	103½	—
L.N.E.R.				
5% Pref. Ord. ...	15⅞	8¼	13½	−½
Def. Ord.	7 9/16	4¾	6½	−¼
4% First Prefce.	74¾	48	75	−1
4% Second Prefce.	31¾	16¼	30½	—
5% Red.Pref.(1955)	92¼	71	96½	—
4% First Guar. ...	103 11/16	93	101	—
4% Second Guar.	98¾	82½	96	—
3% Deb.	86	75	82	—
4% Deb.	109¼	98½	106	—
5% Red.Deb.(1947)	118¼	106½	111½	—
4½% Sinking Fund Red. Deb.	112½	108	109	—
SOUTHERN				
Pref. Ord.... ...	87½	69⅝	92	—
Def. Ord.	25 13/16	16¾	22½	−½
5% Prefce. ...	124	108¼	120½	—
5% Red.Pref.(1964)	117¾	109⅛	116⅛	—
5% Guar. Prefce.	136½	121⅛	131½	—
5% Red.Guar.Pref. (1957)	121¼	112⅛	117⅛	—
4% Deb.	116¾	107	114	—
5% Deb.	138	130¼	135½	—
4% Red. Deb. 1962–67	115	106½	111½	—
BELFAST & C.D.				
Ord.	9	4	4½	−½
FORTH BRIDGE				
4% Deb.	111¼	104¼	104½	—
4% Guar.	109⅞	104	104½	—
G. NORTHERN (IRELAND)				
Ord.	20	7	14½	+½
G. SOUTHERN (IRELAND)				
Ord.	57½	14⅛	57	−1
Prefce.	50	25¼	63¼	+¾
Guar.	88¾	51¼	90	+¾
Deb.	88¼	70	94	—
L.P.T.B.				
4½% "A" ...	130	119¾	124½	+1
5% "A" ...	139¾	130	134⅛	—
4½% "T.F.A." ...	113¾	108	109½	+½
5% "B" ...	131½	122¾	128½	—
"C"	109⅛	91	107	—
MERSEY				
Ord.	23⅛	9¼	29	—
4% Perp. Deb. ...	100½	93½	99	—
3% Perp. Deb. ...	75½	67	74½	—
3% Perp. Prefce.	62	47¼	65⅛	—

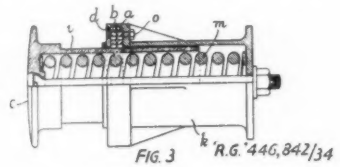
ABSTRACTS OF RECENT PATENTS*

No. 446,842. Buffers for Railway Vehicles

George Turton, Platts & Co. Ltd., of Meadow Hall Road Works, Wincobank, Sheffield, and Frank Hewitt, of "Green Lawn," Green Lane, Dronfield, near Sheffield, in the county of Derby (*December* 4, 1934).

In the improved buffer, rubber springs or pads are accommodated in a socket *b* formed by a rearwardly extending flange b^1 on the buffer head *c*. The pads *a* are retained in position in the socket *b* by means of a flanged retaining ring *d*, to the outer radial face of which are fitted two keys *e* secured by means of set screws *f*, the keys *e* having lugs *g* depending through slots in the ring and slidably engaging slots *h* provided in the buffer plunger *i*, whereby the retaining ring *d* is kept in position. The buffer is of the hollow plunger type and is provided with a spindle *j* passing through the back plate; *k* is the buffer casing and *m* is the main interior buffering element, which may be the usual coil spring or any other resilient member. In



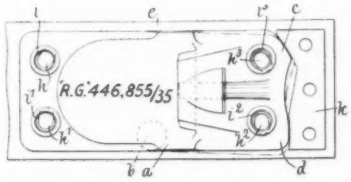


another method of applying the cushioning means, the casing *k* is constructed at its front end to form the socket *b* for accommodating the pads *a* and retaining ring *d*, which is held in position by means of the bolts *o*.—(*Accepted* May 7, 1936.)

No. 446,855. Slide Chairs for Railway Switch Points

Henry Williams Limited, and David Dennis Williams both of Railway Appliances Works, Darlington (*March* 15, 1935).

Slide chairs *a* are provided on the base with a downwardly projecting stud *b*. The stud is in close proximity to one of the longitudinal sides of the chair and is in alignment with the running edge of the switch blade when the latter is in the closed position. The corners *c* and *d* of the end of the chair adjacent to and parallel with the jaw both form arcs of circles, the centre of which is the centre of the stud. The chair is also provided with four bolt holes *i*, i^1, i^2, and i^3. In a further construction the sole plate *e* is provided with two holes *f* and *g*, to receive the studs *b* of the two chairs. It is also provided with four bolt holes *h*, h^1, h^2, and h^3. The bolt holes are not round but are slightly elliptical, the major

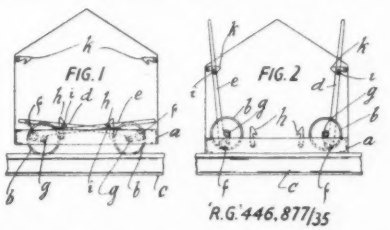


axes of each group coinciding with arcs of circles struck from the centre of the corresponding holes to receive a stud. At the ends of the sole plate, stops *k*, *k* are provided. Each stop comprises a narrow plate riveted to the sole plate, and the inner edges are curved to correspond with the adjacent curved corners of the chairs. The chairs are adjusted and then secured in position by bolts. In this method of mounting, a sole plate is suitable for both left-hand and right-hand turnouts, the chairs being capable of angular adjustment on the sole plate to suit the angle of the switch blades.—(*Accepted May* 7, 1936.)

No. 446,877. Improved Railway Vehicle

Alexander Weidmann and Lloyd Dynamowerke A.G., both of Osterdeich, 253, Bremen, Germany (*October* 2, 1935).

A railway transportable machine combination consisting of an electric generator and a driving motor is provided with means for removing it from

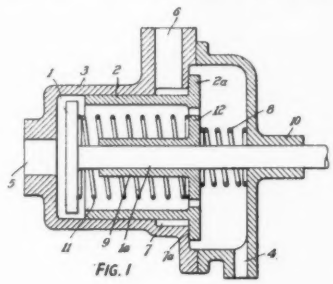


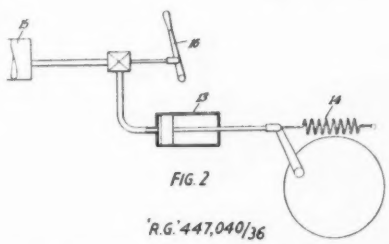
the rails, which means allow the frame *a* of the combination, which stands with its wheels *b* on the rails *c*, to be lowered rapidly on to the rails. The raising or lowering of the frame *a* is effected, after releasing a simple catch such as the hooks *h*, by pivoting the wheels upwardly by means of the levers *d*, *e* which are pivoted on shafts *f* and carry the axles *g* of the wheels *b*. When the hooks *h*, which engage over pins *i* on the levers *d*, are released, the frame moves downward under the action of the weight of the machine combination. On the further movement of the levers *d*, *e*, the wheels *b* are raised clear of the rails so that the frame *a* can then easily be slid off the rails laterally. The levers *d*, *e* may be held in the raised position of the wheels *b* by means of catches *k*. On the side of the truck opposite the levers the wheels *b* are carried on levers secured to the shaft *f* and corresponding to the short arms *f*, *g* of the levers *d*, *e*. In this way it is possible for one operator to release the two levers one after the other and lower the combination very rapidly on to the rails without appreciable impact.—(*Accepted May* 7, 1936.)

No. 447,040. Control Valves for Use in Vacuum Braking Systems

Clayton Dewandre Co. Ltd., Stanley Howard Edge, and Jules Fagard, all of Titanic Works, Lincoln. (*August* 29, 1936.)

The control valve mechanism comprises a disc valve 1 adapted to seat against one end of a hollow cylindrical





valve member 2 mounted to slide in the valve chamber 3 so that the valves 1 and 2 can move together like a piston. The valve chamber has an opening 4 for connection to the brake cylinder, which opening is located on the side of the disc 1, seating against the cylinder 2. An opening 5 for connection to the source of vacuum is provided on the opposite side of the disc 1. An opening 6 in the valve casing communicating with the atmosphere opens into an annular recess 7 formed in the walls of the valve chamber round the valve member 2, which member is formed with a flange 2*a* engaging an annular seat 7*a* formed in the valve chamber so as to control the flow of air into the valve chamber. The valve 2 is normally held closed by a spring 8, and is arranged

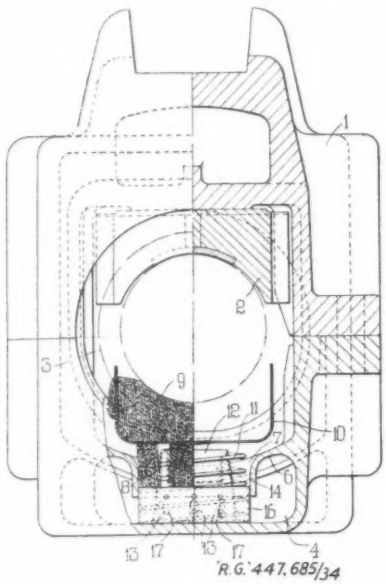
* These abridgments of recently published specifications are specially compiled for THE RAILWAY GAZETTE by permission of the Controller of His Majesty's Stationery Office. Group abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2 either sheet by sheet as issued, on payment of a subscription of 5s. a group volume, or in bound volumes, price 2s. each, and the full specifications can be obtained from the same address price 1s. each

so that after the engagement of the valves 1 and 2, the further movement of the valve 1 moves the valve 2 against the action of the spring 8 and causes air to be admitted from the space 7 into the valve chamber on that side of the valve 1 which faces the opening 4. The disc 1 is mounted on a sliding rod 1*a* which is guided in a bearing sleeve 9 fixed to the valve 2, and projects through one end of the valve chamber as indicated at 10 so that it can be connected to a pedal or control lever. A light spring 11 bears against a perforated flange 12 at one end and against the disc 1 at the other end so as to hold the disc valve in open position when the parts are at rest. 13 represents a vacuum brake cylinder which holds the brake off against a spring 14. The brake cylinder 13 is connected to the opening 4, and the pipe 15, in which a partial vacuum is maintained, is connected to the opening 5. The rod 1*a* is connected to a hand-controlled lever 16. It will be seen that when the lever 16 is moved to apply the brakes the disc 1 first seats against the member 2, thereby cutting off communication between the brake cylinder and the vacuum pipe, and then moves the member 2 so that air is admitted into the interior of the valve chamber and thence through the opening 4 to the brake cylinder. The vacuum in the brake cylinder is thus destroyed and the brake is applied by the spring 14. —(*Accepted May* 12, 1936.)

No. 447,685. Oil Conservor for Railway Rolling Stock Axleboxes

Thomas Hewitt, of "Brantwood," Benton Hill, Horbury, Yorks. (*November* 20, 1934.)

An axlebox 1 of any usual form is provided with a bearing 2 for the axle 3, and has at its base a reservoir for lubricant. The axlebox is provided with a false floor 6 having an opening 7 in which is disposed a number of wicks 8, for leading the lubricant from the reservoir 4 to a pad 9 held within the tray 10, which is pressed up against the axle by means of a compression spring 11. A thimble 12 is provided having perforations 13 for the threading in of the wicks, which thimble has an inturned lip 14 and a lower flange 15 by which it is held in position by means of the spring 11. A sleeve 16 is provided having perforations 17 to fit snugly within the openings 7, so that lubricant can pass into the opening 7 only through these perforations. This sleeve 16 is formed from a strip of spring steel coiled upon itself and tending to spring outwardly. It will consequently be seen that should the axle become tilted or even rotated through 360 deg., lubricant cannot escape from the reservoir 4, but



can pass only into the thimble 12 and then be trapped within the groove or trough 18 formed by the inturned lip 14 and when the vehicle is righted again this lubricant will either percolate back to the reservoir 4 or become absorbed by the wicks within the central space in this thimble 12.—(*Accepted May* 20, 1936.)

COMPLETE SPECIFICATIONS ACCEPTED

446,289. Tomlinson, A. V. (White, J., and Westinghouse Brake Company of Australasia Limited). Braking apparatus for railway and other vehicles.

446,423. Superheater Co. Ltd. Tubular heat-exchange elements and method of making the same.

446,449. Eichelgrün, M., and Judell, O. Railway points.

446,459. Naamlooze Vennootschap Machinericen-en Apparaten Fabrieken Meaf. Signalling apparatus for railway level-crossings.

446,463. Wheaton, A. W. Hose-pipe couplings.

446,516. Babcock & Wilcox Limited. Steam superheaters.

446,565. Schweizerische Industrie-Ges. Rail-guided vehicles.

446,589. Lascelles, T. S., and Sykes Interlocking Signal Co. Ltd., W. R. Block-signalling systems for railways and the like.

446,874. Marjollet, L. L. Arrangements for turning rail and road vehicles and the like.

446,897. Ruyten, H. H. J. Arrangement for guiding vehicles with rubber tyres on railways.

446,907. Union-Kupplung A.G. Automatic couplers for railways or like vehicles.

447,008. Vereinigte Eisenbahn-Signal-Werke Ges. Electrically-operated supervisory systems for railway signals.

447,026. Krupp A.G., F. Double-walled wheels, more particularly for railway vehicles.

447,048. Vereinigte Eisenbahn-Signal-Werke Ges. Railway track brakes operated by the weight of a vehicle.

447,118. Gresham & Craven Limited, Gresham, J. N., and Marsh, G. C. Brake mechanism of railway vehicles.

447,192. Wilson, A. M. Apparatus for cleaning boiler tubes and the like.

447,291. Birmingham Railway Carriage & Wagon Co. Ltd., and Schofield, N. Bogie trucks and suspension gear for vehicles.

447,300. King, T. St. P. C. Pressure relief valves.

447,322. Schmutz, H. Brakes.

447,434. Williams, L. Wynn-. Facing point lock stretcher-bars for railway switch mechanism.

447,598. Babcock & Wilcox Limited. Steam superheaters.

447,648. Böhmer, A. Method and means for weighing railway vehicles.

Northern Railway Officers' Association

This association, which comprises the railways of Sweden, Norway, Denmark and Finland, and issues a monthly journal, the *Nordisk Järnbanetidskrift*, held its twentieth congress at Stockholm from July 23 to 25, about 700 taking part. The last congress was at Helsingfors in 1932 and the next is to be at Copenhagen in 1940. The principal addresses were delivered by the General Managers of the Swedish, Danish and Finnish State Railways, and a former Norwegian Minister of Transport. Herr Granholm (General Manager, Swedish State Railways) pointed out how the development of traffic in Sweden, due in great measure to electrification, had resulted in probably the heaviest average train service handled on what was mostly a single-track railway system, a circumstance which had called for much skill and care in framing the timetables. The administration was anxious to double many of the sections, but could not find the money for it as yet. It was unlikely that the present rates and fares could continue; some reduction would be inevitable before long, and then the railway position would not be so satisfactory.

The prospects for the Danish railways were improving, said Herr Knutzen (General Manager), as a result of recent enterprise. The Little Belt bridge, the fast railcars, and the Copenhagen electrification had all assisted towards it. In Finland the State is pursuing a policy of development which uses the railway system directly to assist industry, and rates are very low. Nevertheless its position is improving. Stock and track are being modernised. A number of technical papers followed the opening addresses and a film display was given by the Swedish Railways, including one of the new Inland line.

RAILWAY AIR SERVICE WITHDRAWALS.—Railway Air Services announces that the seasonal services operating over the following routes were withdrawn on Saturday last, September 12: Manchester-Liverpool-Brighton; Bristol-Plymouth; Cardiff-Weston-super-Mare.

OFFICIAL NOTICES

The Institute of Transport Exams, 1937

NOTICE IS HEREBY GIVEN that the Graduateship and Associate Membership Examinations will be held in London and at other centres on Thursday, Friday and Saturday, April 29th, 30th and May 1st, 1937.

The latest date for the deposit of forms of entry which can be obtained after October 1st, 1936, is March 1st, 1937 (January 1st if any exemptions are claimed). Full particulars, previous question papers (price 1s. per set, post free) and copies of a revised and enlarged edition of the booklet "The Institute of Transport Examinations: Notes for the Guidance of Candidates unable to attend Preparatory Courses" (price 2s. 6d. post free) may be obtained from the undersigned.

By Order of the Council,
A. WINTER GRAY,
Secretary.

15, Savoy Street,
London, W.C.2.
July 14th, 1936.

London & North Eastern Railway

NOTICE IS HEREBY GIVEN that, for the purpose of preparing the Warrants for Interest payable on the 15th October, 1936, on the Company's 5 per cent. Redeemable Debenture Stock, the balance will be struck as at the close of business on 28th September, and such Interest will be payable only to those Stockholders whose names are registered on that date.

Transfers of the 5 per cent. Redeemable Debenture Stock should, therefore, be lodged with the Registrar of the Company at Hamilton Buildings, Liverpool Street Station, London, E.C.2, before 5 p.m. on 28th September.

By Order,
JAMES McLAREN,
Secretary.

Marylebone Station,
London, N.W.1.
16th September, 1936.

PATENTS for Inventions, Trade Marks. King's Patent Agency, Ltd. (B. T. King, Registered Patent Agent). Advice, Handbook and Consultations free.—146A, Queen Victoria Street, E.C.4. 'Phone City 6161. References and experience of the Company and its founder over 50 years.

Universal Directory of Railway Officials and Railway Year Book

42nd Annual Edition, 1936-1937

JUST PUBLISHED

Price 20/- net.

THE DIRECTORY PUBLISHING CO. LTD.
33, Tothill Street, London, S.W.1.

CONTRACTS AND TENDERS

Locomotives for India

The Vulcan Foundry Co. Ltd. has received an order for two metre-gauge P class standard passenger 4-6-0 locomotives and tenders for the Rohilkund & Kumaon Railway, to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

W. G. Bagnall Limited has received an order for two metre-gauge 2-6-2 tank locomotives for the Rohilkund & Kumaon Railway, to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

Wagons for Palestine

The Birmingham Railway Carriage & Wagon Co. Ltd. has received an order from the Crown Agents for the Colonies for 50 four-wheeled covered goods wagons, 4 ft. 8½ in. gauge, complete with wheels and axles and vacuum brake gear for the Palestine Railways.

The Crown Agents for the Colonies have recently placed the following orders:—

Thos. Firth & John Brown Limited, Axles and tyres.
Westinghouse Brake & Signal Co. Ltd., Brake materials.
Chloride Electrical Storage Co. Ltd., Cell spares.
Staveley Coal & Iron Co. Ltd., Cast-iron pipes.
British Insulated Cables Limited, Low-tension cable.
P. & W. MacLellan Limited, Mild steel angles, and mild steel plates.
The Horsehay Co. Ltd., Railway bridge spans.
The Anderston Foundry Co. Ltd., Steel sleepers.
J. Baker & Bessemer Limited, Steel tyres.
Horseley Bridge & Thos. Piggott Limited, Steelwork for suspension bridge.
Tees Side Bridge & Engineering Co. Ltd., Structural steelwork.
Ericsson Telephones Limited, Telephone material.
Cowans, Sheldon & Co. Ltd., Turntable with vacuum engine.
Ward Haggas & Smith, Universal milling machine.

The English Steel Corporation has received an order from the Madras & Southern Mahratta Railway for 60 locomotive tyres to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

The State Railways of Uruguay have ordered three standard gauge railcars from the American Car & Foundry Company.

Kugelfischer, Schweinfurt, Germany, has received orders from both Henschel & Sohn and Fried Krupp A.-G. for sets of 20 roller bearing axle-boxes required for tenders carrying 17-ton axleloads.

The Chief Controller of Stores, Indian Stores Department, has placed the following orders:—

Exors. of James Mills Limited, 85,000 Macbeth steel keys at total price of Rs. 18,183.

Jessop & Co. Ltd., one 60-ton crab complete with 60-ton main hoist and 10-ton auxiliary hoist and motor and spares at total price of Rs. 22,535; one 60-ton overhead travelling crane complete with motor and spares at a total price of Rs. 40,245 and one 8-ton overhead travelling crane complete with motor and spares at a total price of Rs. 15,678.

Leyland Motors Limited has received the following orders from railway associated road transport operators:—Thames Valley Traction Co. Ltd., two oil-engined Titans; and Ribble Motor Services Limited, 15 Tigers and 51 Cheetahs.

The Forges & Acieries de la Marine et d'Homecourt has received from the P.L.M. Railway an order for three heavy diesel-electric shunting locomotives of 570-b.h.p. They will be powered by supercharged Sulzer engines.

The Anderston Foundry Co. Ltd. has received orders from the Bengal & North Western Railway for 10 sets of switches and 10 sets of crossings to the inspection of Messrs. Rendel, Palmer & Tritton.

Dorman, Long & Co. Ltd. has received an order from the Bengal & North Western Railway for 1,929 tons of medium manganese B.S.S. 60-lb. F.F. rails and 5,634 pairs of fishplates to be supplied to the inspection of Messrs. Rendel, Palmer & Tritton.

Powers-Samas Accounting Machines Limited announces that as from September 7 the head office address has been changed to Powers-Samas House, Holborn Bars, London, E.C.1. Tel. No.: Holborn 8711 (8 lines).

Tenders are invited by the Assam-Bengal Railway, receivable by October 19 at 56, Victoria Street, S.W.1, for 10 IRS type MBTP bogie petrol tank wagons.

"THE MODEL ENGINEER" EXHIBITION.—This year's "Model Engineer" Exhibition was opened yesterday (Thursday) at the Royal Horticultural Hall, S.W.1, by the Rt. Hon. Leslie Hore-Belisha, M.P., Minister of Transport, who was supported by Mr. Percival Marshall, Editor, *The Model Engineer*, and Mr. S. E. Garcke, a Past President of the Institute of Transport. The exhibition remains open until Saturday, September 26. As in the past, the competition section, which, incidentally, has grown considerably this year, produces many fine exhibits of railway interest, outstanding among which are two large-scale Pacific-type locomotives, one a ¾-in. scale model of the old G.W.R. *Great Bear*, and the other a 3½-in. gauge L.M.S.R. *Princess Royal*. Indeed, there seems to be a tendency this year for competitors to concentrate on the larger scales, and the locomotives noticeably predominate over coaching and goods stock. In addition to the many intriguing trade displays, there are some excellent examples of the amateur's art to be found on the stands occupied by, among others, the Model Railway Club, the Society of Model and Experimental Engineers, and the Wimbledon Model Railway Club.

Forthcoming Events

Sept. 17–26.—"Model Engineer" Exhibition, at Royal Horticultural Hall, Vincent Square, London, S.W.1.

Sept. 19–23.—Commercial Motor Users' Association, at Brighton. National Road Transport Conference.

Sept. 26 (*Sat.*).—Permanent Way Institution (Manchester-Liverpool). Visit to Blackpool Corporation Gas Works.

Oct. 23–24.—L.M.S.R. (London) Dramatic Society, at the Cripplegate Institute Theatre, Golden Lane, E.C., 8 p.m. "The Last of Mrs. Cheyney."

Oct. 6.—York Railway Lecture and Debating Society, at Railway Institute, York, 6.45 p.m. "Palestine and its Problems" (illustrated), by Mr. C. M. Jenkin Jones.

XUM

Railway Share Market

Despite the unsettling influence of developments in the European political situation which has led to an easier tendency in the stock and share markets, Home Railway stocks have been relatively well maintained. If market conditions had been more buoyant, it is possible prices might have responded strongly to the further good batch of traffic figures which show an aggregate increase of £110,000 for the past week and raise the total aggregate increase for the year to date to £3,458,000.

Great Western ordinary stock was the outstanding feature with a rise to 54½. The demand was due not so much to the past week's traffics (which show a gain of £13,000) as to a more general realisation of the apparently attractive yield offered on the basis of the 3 per cent. dividend—which it is being confidently expected will be maintained, although it will probably entail a further moderate withdrawal from reserves. L.M.S. stocks were steady on the good traffic increase of £47,000. If, as is being predicted, the traffic figures continue to show an encouraging trend for the rest of the year, there are said to be possibilities of very satisfactory response by the 1923 preference. The ordinary stock has made the rather lower price of 27⅜, due partly to the view that it probably already discounts a possible dividend of 1 per cent. for the current year, but there is little doubt that the price can be expected to respond readily if traffic gains are continued on the scale shown in recent weeks. The second preference was the most active of the L.N.E. stocks, and has remained fairly steady at 30½. The preferred was fractionally higher at 13¾ following the news of last week's traffic gain of £35,000. The Southern reports a traffic increase of £15,000 for the past week and the deferred was maintained around 22½. The preferred was active around 92 and is expected in some quarters to reach par as time proceeds, granted that during the next six months traffic figures are of a favourable character. Debenture stocks of the main line railways are very firm. London Transport "C" stock was little changed and the "A" improved half a point to 125.

The chief feature among foreign railway stocks was increased activity reported in most of the ordinary stocks of the Argentine railway companies. Demand was attributed to hopes that at the forthcoming annual meetings more favourable views of prospects may be expressed. B.A. Great Southern, B.A. Western and B.A. Pacific each gained about half a point. San Paulo moved up three points further to 67½, aided by the good traffic return, and Leopoldina was better. Antofagasta improved.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1935-36	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1935	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1935	Prices: Lowest 1935	Prices: Sept. 16, 1936	Prices: Yield (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili) & Bolivia	834	13.9.36	13,250	– 490	37	498,890	453,860	+ 45,030	Ord. Stk.	23	14 15/16	18	Nil
	Argentine North Eastern ..	753	12.9.36	9,971	+ 353	11	100,039	91,582	+ 8,457	,,	7	4	31/2	Nil
	Argentine Transandine ..	—	—	—	—	—	—	—	—	A. Deb.	49 1/2	30	47 1/2	8 7/8
	Bolivar	174	Aug., 1936	4,900	– 700	35	52,500	50,300	+ 2,200	6 p.c. Deb.	13	5	10	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	14	11	15 1/2	3 1/4
	Buenos Ayres & Pacific ..	2,806	5.9.36	74,309	+ 3,140	10	714,163	719,205	– 5,042	Ord. Stk.	101 1/2	47 8	71/2	Nil
	Buenos Ayres Central ..	190	22.8.36	$128,600	+ $11,400	8	$990,900	$984,000	+ $6,900	Mt. Deb.	21	10	14	Nil
	Buenos Ayres Gt. Southern	5,084	12.9.36	112,176	– 20,355	11	1,171,902	1,298,172	– 126,270	Ord. Stk.	27	13 1/2	16 1/2	Nil
	Buenos Ayres Western ..	1,930	12.9.36	37,412	– 638	11	420,702	441,384	– 20,682	,,	24	10	13 1/2	Nil
	Central Argentine	3,700	12.9.36	152,891	+ 31,869	11	1,438,965	1,296,772	+ 142,193	,,	17 7/8	7	11 1/2	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	9	3 1/4	7	Nil
	Cent. Uruguay of M. Video	273	5.9.36	9,440	+ 1,219	10	100,703	84,583	+ 16,120	Ord. Stk.	8 1/2	3	4	Nil
	Do. Eastern Extn.	311	5.9.36	1,566	– 291	10	16,580	13,786	+ 2,794	—	—	—	—	—
	Do. Northern Extn.	185	5.9.36	1,157	+ 157	10	14,623	10,966	+ 3,657	—	—	—	—	—
	Do. Western Extn..	211	5.9.36	889	+ 64	10	8,997	7,082	+ 1,915	—	—	—	—	—
	Cordoba Central	1,218	12.9.36	33,060	+ 3,470	11	396,910	366,100	+ 30,810	Ord. Inc.	4	1	1 1/2	Nil
	Costa Rica	188	July, 1936	21,438	+ 7,708	4	21,438	13,730	+ 7,708	Stk.	35	30	33	6 1/16
	Dorada	70	July, 1936	16,000	+ 2,400	31	95,300	80,400	+ 14,900	I Mt. Db.	103 5/8	102 1/2	104 1/2	5 1/4
	Entre Rios	810	12.9.36	13,476	+ 898	11	132,132	134,903	– 2,771	Ord. Stk.	15	6 1/2	7	Nil
	Great Western of Brazil ..	1,082	12.9.36	6,200	+ 500	37	269,600	268,000	+ 1,600	Ord. Sh.	1/2	5/16	1/2	Nil
	International of Cl. Amer.	794	July, 1936	$310,697	– $17,787	31	$3,307,311	$2,960,670	+ $346,641	—	—	—	—	—
	Interoceanic of Mexico ..	—	—	—	—	—	—	—	—	1st Pref.	1/2	5/32	1/2	Nil
	La Guaira & Caracas ..	22¾	Aug., 1936	4,945	+ 1,090	35	37,195	31,425	+ 5,770	Stk.	8 1/2	8	5 1/2	Nil
	Leopoldina	1,918	12.9.36	20,113	– 686	37	685,727	828,018	+ 57,709	Ord. Stk.	8 1/2	2 1/2	5	Nil
	Mexican	483	7.9.36	$252,700	+ $10,700	10	$2,452,000	$2,437,800	+ $14,200	,,	1 1/2	1/4	1/2	Nil
	Midland of Uruguay ..	319	Aug., 1936	7,887	+ 2,378	9	15,621	11,011	+ 4,610	,,	1 1/2	1 1/2	1/2	Nil
	Nitrate	397	31.8.36	2,008	– 5,516	35	86,121	101,134	– 15,013	Ord. Sh.	64/–	42/–	2 5/8	Nil
	Paraguay Central	274	12.9.36	$2,826,000	+ $3,900	11	$28,288,000	$24,279,000	+ $4,009,000	Pr. Li. Stk.	80 1/2	60	72 1/2	8 1/4
	Peruvian Corporation ..	1,059	Aug., 1936	87,240	+ 12,556	9	171,561	148,497	+ 23,064	Pref.	10 5/8	6 7/16	11	Nil
	Salvador	100	5.9.36	¢14,800	+ ¢3,125	10	¢107,974	¢119,486	– ¢11,512	Pr. Li.Db.	65	61	15	Nil
	San Paulo	153½	6.9.36	32,083	+ 11,109	36	1,077,486	858,068	+ 219,418	Ord. Stk.	80	35	68	$2 3/32
	Taltal	164	Aug., 1936	3,625	+ 1,205	9	6,150	4,945	+ 1,205	Ord. Sh.	11 1/16	1 1/8	7/8	12 5/16
	United of Havana	1,353	12.9.36	14,658	– 2,655	11	172,117	195,436	– 23,319	Ord. Stk.	3 1/16	1	2 1/2	Nil
	Uruguay Northern	73	Aug., 1936	778	+ 213	9	1,644	1,199	+ 455	Deb. Stk.	4 1/2	2 15/16	4 1/2	Nil
Canada.	Canadian National	23,615	7.9.36	731,878	+ 106,404	36	24,030,148	22,471,286	+ 1,558,862	—	—	—	—	—
	Canadian Northern ..	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	78 3/8	52 1/2	67 1/2	5 15/16
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	103 3/8	93	101 1/2	3 15/16
	Canadian Pacific	17,237	7.9.36	618,800	+ 126,800	36	17,745,000	16,211,000	+ 1,534,000	Ord. Stk.	14 1/16	8 3/4	12	Nil
India.†	Assam Bengal	1,329	20.8.36	34,297	+ 5,218	20	473,350	455,033	+ 18,317	Ord. Stk.	92 1/8	77 1/2	85 1/2	3 1/2
	Barsi Light	202	20.8.36	2,572	– 180	20	50,512	59 602	– 9,090	Ord. Sh.	105	77 1/2	72 1/2	6 7/8
	Bengal & North Western ..	2,112	20.8.36	63,262	+ 8,935	20	1,075,763	1,007,138	+ 68,625	Ord. Stk.	301 1/2	291	310	5 5/16
	Bengal Dooars & Extension	161	31.8.36	4,122	– 951	21	52,053	52,730	– 677	,,	127 1/2	122	125 1/2	5 9/16
	Bengal-Nagpur	3,268	20.8.36	143,550	+ 1,299	20	2,351,806	2,486,552	– 134,746	,,	105	100 5/16	102 1/2	3 7/8
	Bombay, Baroda & Cl. India	3,072	10.9.36	192,900	+ 21,900	23	3,665,700	3,408,750	+ 356,950	,,	115 1/4	110	112 1/2	5 11/32
	Madras & Southern Mahratta	3,229	20.8.36	131,025	+ 1,791	20	2,229,103	2,165,771	+ 63,332	,,	128 1/2	113 7/8	112 1/2	8
	Rohilkund & Kumaon ..	546	20.8.36	10,417	+ 1,554	20	213,684	192,674	+ 21,010	,,	294	262	308 1/2	5 5/16
	South Indian	2,532	20.8.36	99,801	+ 1,341	20	1,567,144	1,594,476	– 27,332	,,	119 3/4	104 1/4	103 1/2	5 5/16
Various.	Beira-Umtali	204	June, 1936	64,192	+ 8,141	39	577,342	576,265	+ 1,077	—	—	—	—	—
	Bilbao River & Cantabrian	15	July, 1936	1,677	+ 547	31	10,202	11,035	– 833	—	—	—	—	—
	Egyptian Delta	620	31.8.36	6,363	– 176	21	88,439	82.745	+ 5,724	Prf. Sh.	2	15/8	1 3/4	5 11/16
	Great Southern of Spain ..	104	29.8.36	568	– 2,514	35	33,629	62,623	– 28,994	Inc. Deb.	31/2	2	31/2	Nil
	Kenya & Uganda	1,625	July, 1936	184,229	+ 4,788	30	1,614,901	1,472,623	+ 142,278	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	48	36	43	9/8
	Mashonaland	913	June, 1936	100,926	– 1,113	39	916,081	1,047,960	– 131,879	1 Mg. Db.	104 1/4	100	103 1/2	4 15/16
	Midland of W. Australia ..	277	July, 1936	10,214	– 794	4	10,214	11,008	– 794	Inc. Deb.	98 3/4	93	95	4 8/16
	Nigerian	1,905	1.8.36	24,016	+ 6,779	18	509,162	437,347	+ 71,815	—	—	—	—	—
	Rhodesia	1,538	June, 1936	188,938	+ 6 401	39	1,668,785	1,724,710	– 55,925	4 p.c. Db.	105 1/2	101	106	3 3/4
	South African	13,263	22.8.36	627,678	+ 77,910	21	12,247,244	11,227,459	+ 1,019,785	—	—	—	—	—
	Victoria	4,728	May, 1936	779,712	+ 8,120	48	8,986 232	8,734,254	+ 251,978	—	—	—	—	—
	Zafra & Huelva	112	May, 1936	8,821	– 2,027	22	48,574	55,398	– 6,823	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16.

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rates of exchange and not on the par value.

Electric Railway Traction

Conductor Rail Alterations

AN interesting contrast can be made between the methods adopted by the Mersey Railway in moving the position of its positive conductor rail to the new Ministry of Transport standard location and those followed by the L.N.E.R. in carrying out a similar operation on the Tyneside lines. The latter was described in our issue of June 26, and in the present issue we give an account of the former. In both instances the alteration was necessitated by the linking up of the old systems with new electrified lines built to the standards laid down by the Ministry of Transport in 1932. The Mersey Railway, being without steam locomotives, was left with the alternatives of closing down the line entirely for a day or two or fitting extra equipment to the rolling stock and carrying out the change over a period of weeks. On the other hand, the L.N.E.R. had plenty of steam locomotives at its disposal, and was able to run sufficient steam trains to maintain the regular passenger service during the three days required for the work. Of course, in each case a good deal of preliminary work was necessary in the way of fabricating and erecting brackets, and planning all details of the operation. An important factor in the smooth working of the Mersey change-over was the decision to alter the position of the positive conductor rail over the whole of the down line before proceeding with the up tracks. This resulted in double collecting shoes being required only on one side of the trains at a time. The normal collecting shoes were supported by wooden beams and it was necessary to make the brackets and second shoes of very light design to prevent an excess of weight being put upon the beam. During the transition period 112 light brackets and 224 shoes were in use without any breakage occurring.

Welded Rail Bonds

RAIL bonding of the conductor and negative return rails generally has been carried out on the pressed-in system, in which two holes are drilled in the end of each rail and the bond attached by pressing in copper plugs. To overcome the disadvantages of this method, including the cost of drilling the rails, the weakening of the rail web, and the decline in the electrical efficiency of the bond during its life, welded bonds have been introduced into England within the last year or two. Microscopic examination and physical tests have shown that the adherence of the welded bond to the rail is good, and that, within the relatively limited time in which welded bonds have become general, there is little or no loss in electrical efficiency with increasing age. Moreover, the bonds for return currents, at least, can be attached to the side of the rail head, where they are put in position and inspected very easily. The actual welding, the effect of the welding heat on the rail, the electrical tests, and the training of welders are dealt with in a most interesting paper entitled " Rail Bonding by the Oxy-Acetylene Process," which was read before the XIIth International Acetylene Congress by Messrs. C. G. Bainbridge and R. E. Doré. Traction bonds are generally of the U type consisting of two ropes of stranded copper wire with a load capacity of 1,000 amp. and peak loads of 1,600 amp. for 30 sec. Conductor rail bonds, also, are usually of the U type, but are connected to the underside of the rail flange, and consist of at least four ropes of stranded copper wire with a load capacity of 4,500 amp. and a peak capacity of 6,000 amp. for 30 sec. Copper strips are sometimes used instead of strands, an example of this practice being found on the Southern Railway. The heat effect varies slightly with different compositions. With 1·0 per cent. chromium rails with a normal Brinell number of 240-260, the area immediately adjacent to the weld is hardened to about 300. On the other hand, with the B.S. medium manganese rail the effect is to soften the side of the rail against the weld to about 230, with a belt of softer material inside reduced to a Brinell number of about 200. The authors rightly emphasise the convenience of the welding method when bonds have to be applied to rails already laid, for the welding can be done *in situ*, and occupies on an average only 3 min. for a signal bond, 4½ min. for a traction bond, and 12 min. for a conductor rail bond.

The Pennsylvania Electrification

THE project for the electrification of the New York to Washington main line of the Pennsylvania Railroad was announced in 1928. Work was begun in 1929, and was carried through continuously until the opening of the final length between Wilmington and Washington in February, 1935. Complete departures from previous Pennsylvania electric locomotives were necessitated by the type and volume of traffic to be hauled, and because of the progress made in technical directions since the appearance of the last new Pennsylvania design in 1924. Over 250 electric locomotives of six classes have been built for this main line electrification, comprising with existing suburban zones at New York and Philadelphia a total of 364 route and 1,405 track miles, but one of these classes is no longer considered as a standard for new construction. Apart from suburban traffic, which is handled by multiple-unit trains, the entire shunting, freight and passenger traffic (consuming over 700 million kWh. of energy annually) is dealt with by electric locomotives, except for a few trains from steam-worked branches which may run under that power to the first convenient point on the electrified system. The later electrification work was financed under the P.W.A. scheme for finding employment, as it was felt that otherwise the completion of the work might be delayed by the falling traffics resulting from the prevalent slack business. The construction of 57 high speed passenger locomotives, 28 express passenger locomotives, and 14 shunting engines at a cost of about $22,000,000 under the auspices of the P.W.A., occupied about 7,000,000 man-hours of work, a figure which appears to be viewed with pride by the P.W.A. and the railroad. But it seems a little strange that all this work to cure unemployment should be expended on projects that tend ultimately to intensify unemployment.

NEW RECTIFIER EQUIPMENT FOR THE LONDON PASSENGER TRANSPORT BOARD

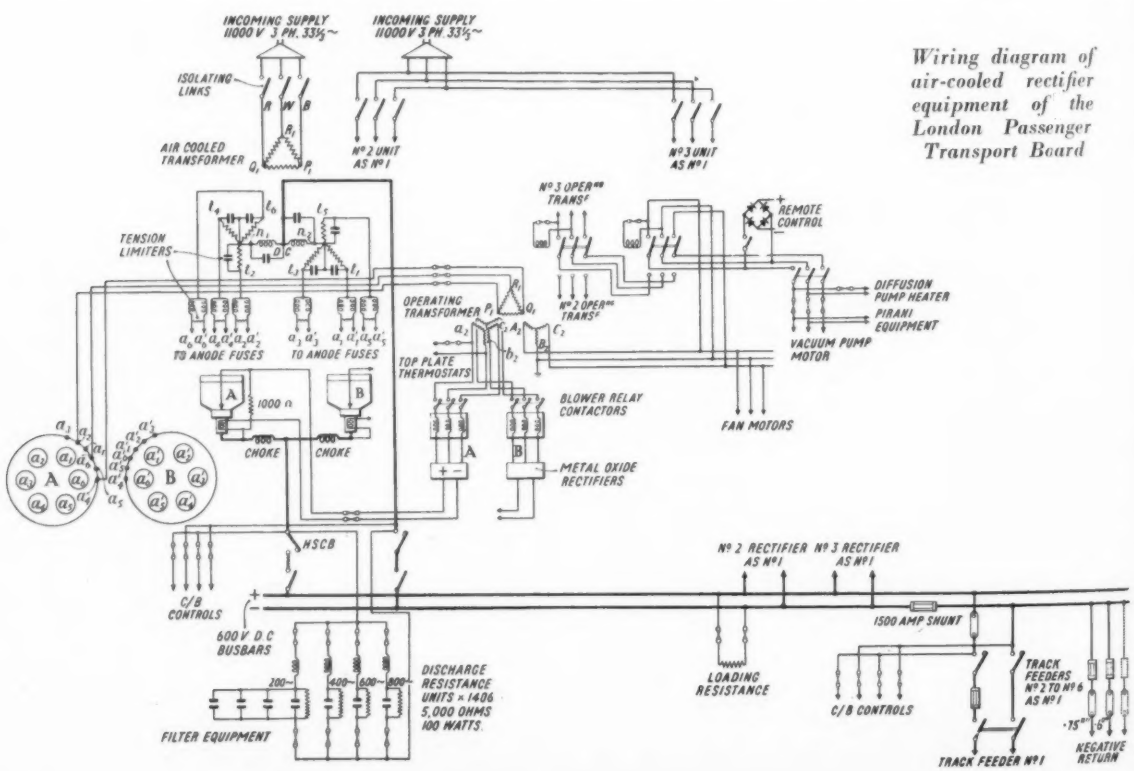
IN the Putney Bridge substation of the London Passenger Transport Board has been installed converting equipment of an unusual type, in the form of air-cooled steel tank rectifiers.

Built by the General Electric Co. Ltd. at its Witton works, these rectifier equipments enable the use of pumps to be dispensed with, thus affording a self-contained rectifying unit which offers the advantages of the robust construction associated with steel tank apparatus. Among other advantages are those shared with rectifiers in general, such as high efficiency, heavy overload capacity, the ability to withstand short circuits, and freedom from backfiring.

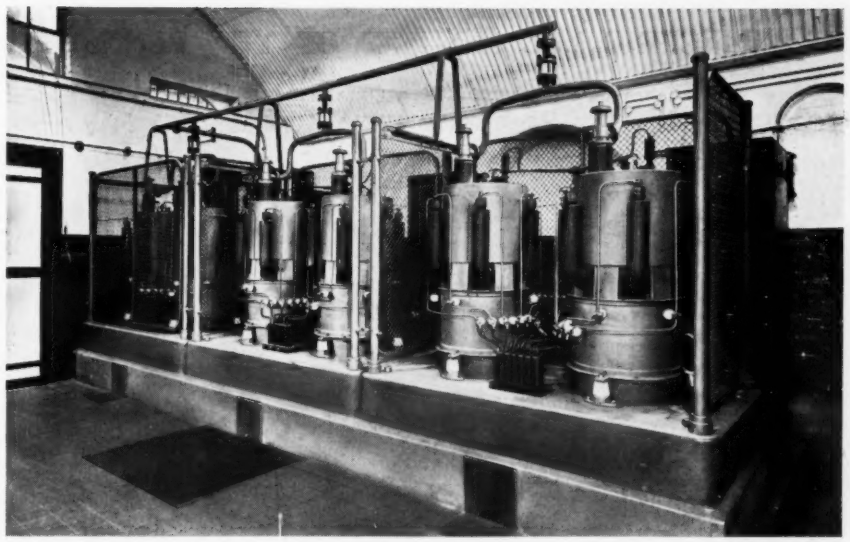
It is claimed that the success which has attended the manufacture of the air-cooled steel tank rectifier is due largely to the patented vitric seal, which is employed by the G.E.C. for all its steel rectifiers. This seal consists of a number of thin mild steel cones, which are separately coated with a special vitreous enamel. After assembly the cones, together with the top and bottom members, are fused up solid in an electrically-heated oven. The resulting seal has a high dielectric strength, is perfectly vacuum-tight and can be secured to the rectifier in the simplest way, all metal-to-metal joints being welded. A patented system of air-cooling has been adopted for the rectifiers, and which has proved effective in service. It enables the maximum possible output to be obtained from a given size unit.

There are three of these 250 kW. rectifier units installed at Putney Bridge, and they supply power at 600 volts d.c. Their outside appearance and a wiring diagram of the substation are shown in the accompanying illustrations. Each unit comprises two six-anode rectifiers. The substation is normally unattended and is remote-controlled from an adjacent railway substation. Provision also is made for emergency remote control of the outgoing d.c. feeders from pillars which are installed at convenient points along the routes so that in the event of an accident power can be cut off quickly from any section of the system should this be necessary.

Three-phase power at 11,000 volts 33⅓ cycles is supplied to the substation through two feeders, one of which supplies one rectifier unit, and the other the two rectifiers which are arranged to operate in parallel. The incoming feeders are connected through isolating links to the primary windings of the main transformers. Provided the incoming high tension isolating links are closed, it is only necessary to close the oil circuit-breaker at the remote control station when the rectifying plant will start up automatically. On operating this switch, the primary of the appropriate main transformer is energised, and this in turn supplies power to the small auxiliary transformer. The cooling fans start up immediately, and when an adequate air flow is established the blower relay operates and the rectifier ignition and excitation circuits are energised. The rectifier unit is thus brought into service. As soon as a d.c. voltage is established at the rectifier terminals, the reverse current high-speed circuit-breaker in the positive main closes, and this operation is followed immediately by the closing of the negative



Wiring diagram of air-cooled rectifier equipment of the London Passenger Transport Board



A bank of three 250 kW. 600 volts rectifiers of the G.E.C. steel tank air-cooled type installed in the Putney Bridge substation of the London Passenger Transport Board. Air-blast transformers are used in conjunction with this equipment

contactor, which is gang-controlled with the high-speed breaker. The rectifying plant is thus connected to the busbars of the d.c. switchboard.

To close down a rectifier, the remote-control breaker is tripped. All the control equipment at the substation will reset automatically in readiness for re-starting. The main d.c. switchboard includes three rectifier panels, an output and test panel, six feeder panels and a B.O.T. panel. This board is arranged so that the total output from the substation is fed through the output and test panel, where it is metered and passed through a summation overload relay to the six feeder panels.

In the event of an overload on the substation, the summation overload relay operates after a predetermined time and trips all feeders simultaneously. Arrangements are also made to trip all feeders when the entire rectifier plant is shut down. Faults on individual feeders are cleared rapidly and without disturbance to the rest of the system by means of high-speed circuit-breakers mounted above the switchboard. Should a high-speed breaker with its gang-controlled negative contactor open on a fault, an auto-reclose relay is brought into operation and after a given time again closes the breaker and its contactor. If the fault persists, the auto-reclose relay will lock out after a given number of reclosures have taken place. After the fault has been rectified, the auto-reclose relay can be reset from the remote control pillars along the routes, so that it is not necessary for an attendant to visit the substation.

Safety Equipment

For safeguarding the installation against damage from faults on the system or in the rectifying plant itself, the following protective features are provided.

(*a*) *High-tension overload and earth leakage*.—Each of the high-tension circuit breakers is equipped with double-pole overload and single-pole earth leakage relays, which trip the breaker in the event of an overload or earth fault in the primary windings of the main transformer, and thus shut down the rectifier.

(*b*) *Protection against overheating of the rectifier top plate*.—If the rectifier becomes overheated due to continued heavy loads, a thermostat fitted in the rectifier top plate trips the high-speed breaker and isolates the unit until it has cooled down to a safe temperature. The thermostat contacts then open, thus closing the breaker and restoring the load on the rectifier.

(*c*) *Failure of cooling air*.—Blower relays are provided which prevent the rectifier ignition equipment from operating until an adequate flow of cooling air has been established. In the event of failure of the cooling air system when a rectifier is in service, the relays trip the high-speed breakers and switch off the excitation arc.

(*d*) *Overloading of the fan motors*.—If a fan motor becomes overloaded it is isolated from the supply by means of an overload relay. The resulting failure of the air flow causes the blower relay to operate and shut down the appropriate rectifying unit.

(*e*) *Protection against fire*.—In order to minimise fire hazard, thermostats are mounted above the main transformers, and trip the appropriate high-tension oil circuit-breaker in the remote control station if the heat produced by any of the transformers be abnormal.

Transformers

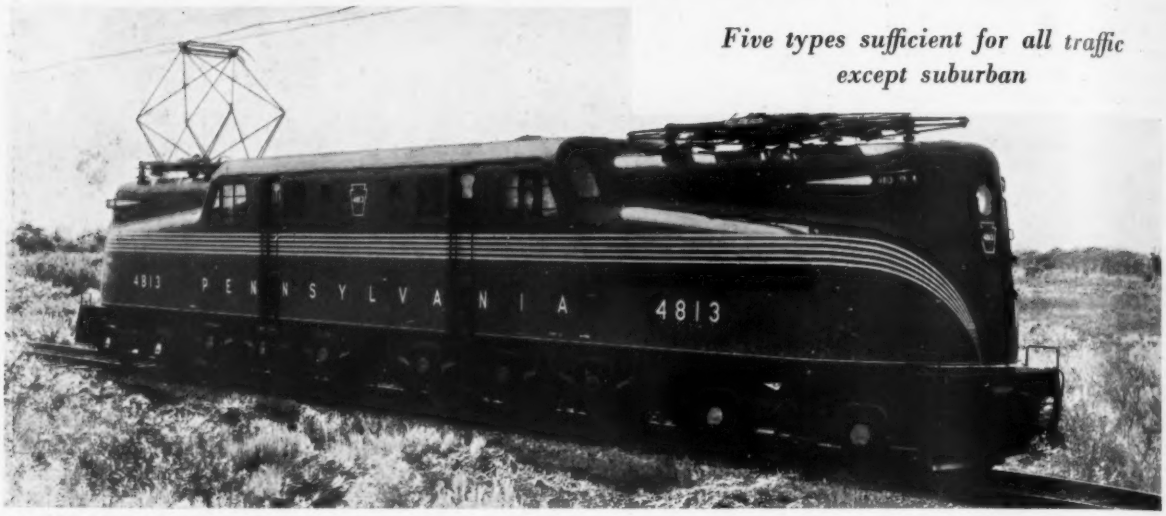
The main transformers are of the three-phase core type, and are designed for air-blast cooling, following normal L.P.T.B. practice for the Underground. Each transformer is mounted on a brick chamber into which the cooling air is blown by the fan, whence it passes through ducts in the windings and is exhausted through an adjustable baffle embodied in the top of the transformer housing. As each transformer supplies the two rectifying cylinders which form a complete unit, balancing choke coils are provided to ensure equal distribution of the load.

Three small transformers, each of which is energised from the low-tension side of the appropriate main transformer, supply power for all the auxiliary equipment and are designed with three three-phase secondary windings. Two of the windings are completely insulated from earth and supply current for the rectifier ignition and excitation equipment, while the third, one phase of which is earthed, provides power at 230 volts for the cooling-fan motors for the main transformers and rectifiers, as well as for operating contactors, relays and so on. Precautionary measures are adopted for minimising interference with radio and communication services, which might occur as a result of ripples in the d.c. output of the rectifier. For this purpose smoothing apparatus has been installed and includes a series-connected reactor coil for each rectifier cathode, and resonant filter circuits which are tuned for the principal harmonics in the d.c. output.

XUM

ELECTRIC LOCOMOTIVES OF THE PENNSYLVANIA RAILROAD

Five types sufficient for all traffic except suburban



The biggest express passenger locomotives for the New York to Washington service, the 4,620 h.p. GG-1 class

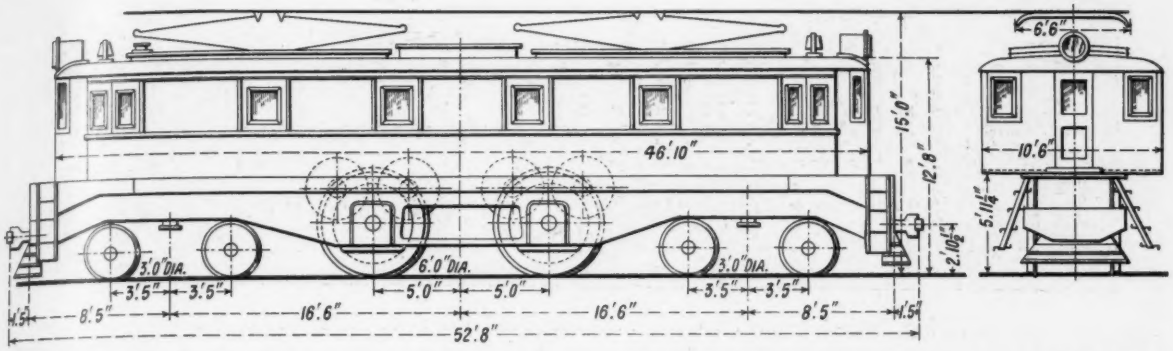
THE electrification of the Pennsylvania Railroad began in 1906 when the West Jersey and Seashore line was converted to 600 volts d.c. for operation by multiple-unit trains. The nucleus of the present single-phase electrified system—the largest steam railway electrification in the world—was the New York to Manhattan Transfer section, which comprised 13½ route miles from Sunnyside yards through New York and under the Hudson river to the Manhattan transfer yard, electric operation of which began in 1910. The original electrification was to 600 volts d.c. but conversion to 11,000 volts 25 cycles single-phase took place some years ago. The electrification in the Philadelphia district began in 1915, and has always been on the single-phase principle.

Locomotives of exceptional characteristics have been used on the Pennsylvania electrified lines ever since the conversion of the Manhattan lines, when both passenger and freight trains were operated in and out of New York by 2-B-B-2 locomotives of 2,000 h.p. with rod drive. This type of drive, and indeed the whole design of the locomotives, was subjected to a great deal of research, principally connected with vibrations and riding qualities. For trial purposes, a 4,000 h.p. single-phase freight locomotive, known all over the Pennsylvania system as "Big Liz," was built in 1917, and was used in the Philadelphia district, but the eventual standard locomotive built for the Philadelphia freight trains was a 1-BB-1 machine of 3,000 h.p. By a change of gear ratio this locomotive class was made suitable for the operation of passenger traffic, and shortly after the first batch was built in 1924, the same design was modified to d.c. for use in the New York district. By 1925 the Pennsylvania had 69 electric locomotives and 293 motor-coaches in operation, these totals not including the extensive electric stock of the subsidiary Long Island Railroad.

Main Line Locomotives

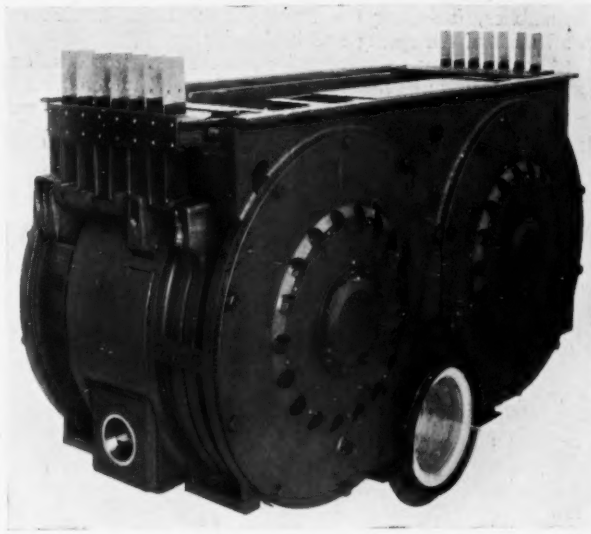
No further high-power designs were produced until the electrification of the 225-mile main line from New York to Washington was sanctioned. For the operation of

Electric passenger locomotive of 2,500 h.p. as used for ordinary trains on the electrified single-phase routes of the Pennsylvania Railroad



Above: Diagram of 2,500 h.p. passenger locomotive with individual axle drive

Below: Double-armature motor used as a standard on four main-line classes



freight and passenger traffic over the initial section from New York to Philadelphia three types of locomotive were built, the first, for ordinary passenger trains, making its appearance in 1930. In addition there was built a class of Co shunting locomotives. The main characteristics of these four classes are given in the table below.

Class	P-5	O-1	L-6	B-1
Wheel arrangement	2-Co-2	2-Bo-2	1-Do-1	Co
Service	Exp. Pass.	Pass.	Freight	Switching
H.P., continuous	3,750	2,500	2,500	570
Corresp. speed, m.p.h.	63	63	38	16
,, tract. eff., lb.	22,300	14,900	24,800	13,500
Max. speed, m.p.h.	90	90	54	25
Adhesion weight, tons	100·5	67	107·2	70·8
Total weight, ,,	167	134	147	70·8
Wheel diam., in.	72	72	62	62

The express passenger locomotives of the 2-Co-2 type and the ordinary passenger locomotives of the 2-Bo-2 wheel arrangement are similar in many respects. Both classes incorporate indentical individual axle drives and spring-supported single-phase commutator motors with double armatures. For the first 90 locomotives a cup type of quill drive, similar to the Secheron and Westinghouse types, was used, and after observing the behaviour the general design was perpetuated for the subsequent locomotives. The axleboxes are all of the roller bearing type. An exceptional degree of standardisation has been attained with the three main-line classes. Although the P-5 and O-1 motors are of the twin type, and the L-6 motors axle-hung, the armatures and stators of all are identical except that the L-6 armature shaft has a slightly larger pinion bearing. The stators are pressed into the motor frame required. Also standard among the three classes are the master controllers, air compressors, and motors, unit switches, pantographs, blower motors, and

One of the 3,750 h.p. P-5 electric locomotives of the Pennsylvania Railroad, built for passenger traffic in 1931–33 and now transferred to freight trains

3,750 h.p. 2-Co-2 locomotive of the non-streamlined P-5 type, Pennsylvania Railroad

relay systems, and the transformers and preventive coils of the O-1 and L-6 locomotives are the same. Duplicate between the P-5 and O-1 classes are the driving wheel assemblies, including the bearings; the truck assemblies; and most of the spring and brake rigging.

Apart from the comprehensive system of standardisation, all three classes of main-line locomotives were constructed to interchangeable limits, so that any armature, brush-holder, control unit, transformer, &c., would go on any locomotive in the series. This interchangeability also is a feature of the newer locomotive types. The main frames all are in the form of a single steel casting, or locomotive bed, in which are cast the water and oil reservoirs for the oil-fired steam heating boilers, and the air-reservoirs for the brakes and electro-pneumatic control system. The cab foundation of all classes is an aluminium structure, from which is built up the shell of the driving and equipment compartments.

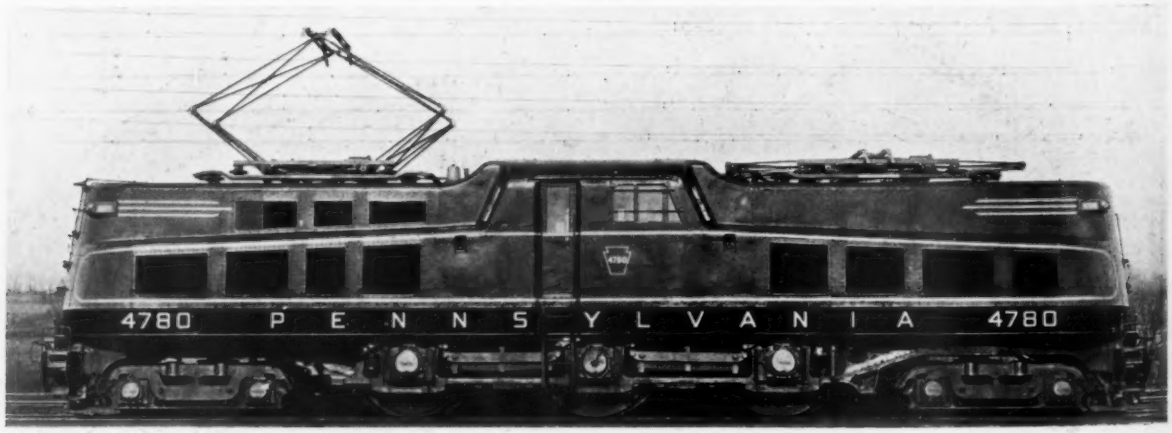
Streamlined Types

Extensive running experience with the three classes described above led to two further passenger locomotive designs when the conversion of the Philadelphia—Washington section was approaching completion. The first is of the 2-Co-2 type, and is classified as P-5A; it is taking the place of the P-5 locomotives built in 1931-33, which are being transferred to express freight services to take the place of the L-6 type, the building programme of which has been curtailed. The second new class is used on the through expresses between New York and Washington; it is of articulated construction with the 2-Co+Co-2 wheel arrangement, and is classified as GG-1. Both the new types are of streamlined contour as regards the superstructure, but the shrouding is not extended downwards to cover the wheels.

Although resembling in general the earlier P-5 class, the 28 locomotives of class P-5A have been entirely redesigned as regards the cab, and one central driving compartment is provided in place of two, and the equipment moved from the centre to the ends. The overall length is 62 ft. 8 in. and the weight 176 English tons. Their speed and tractive effort characteristics and the power are the same as given in the preceding table for the P-5 class, but the adhesion weight has been raised slightly to 102·2 English tons.

The GG-1 type resulted from the construction of two experimental locomotives in 1934, one designated as GG-1 and the other as R-1. The former being found the most suitable, sanction was given for the construction of a further 57 units. Of this total 18 were built and the electrical equipment erected at the Altoona works of the Pennsylvania; 25 by the Baldwin Locomotive Works; and 14 at the Erie works of the American General Electric Company. The electrical equipment for 34 locomotives was built by the Westinghouse Electric & Manufacturing Company, and for the remainder by the American G.E.C. Mr. F. W. Hankins, the Superintendent of Motive Power of the Pennsylvania, was responsible for the general design and supervision. The newest types of locomotives, the P-5A, GG-1 and the 2-Do-2 experimental locomotive of class R-1 were built under the Public Works Administration financing scheme.

With a continuous rated output of 4,620 h.p. at 90 m.p.h. the GG-1 class is probably the most powerful high-speed electric passenger locomotive in the world. The short-time rating is 7,000 h.p. and the starting tractive



2-Co-2 express locomotive of the latest streamlined type, class P-5A, used for the lighter through trains and inter-city fast trains on the Pennsylvania electrified system

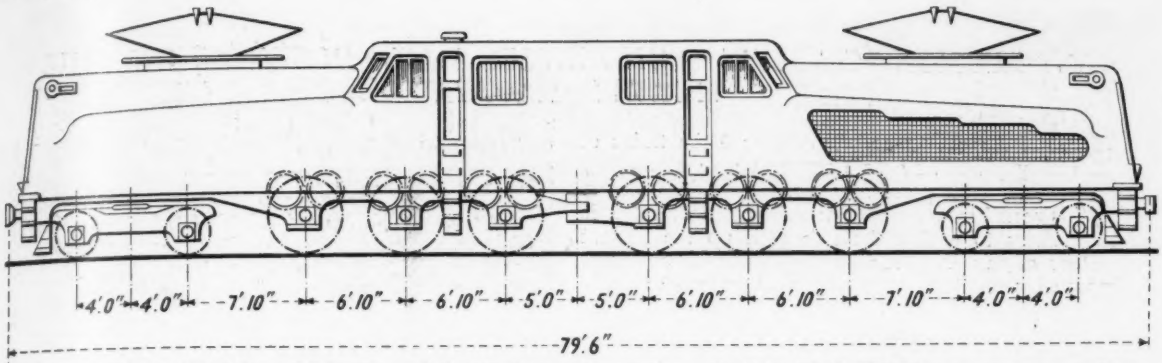


Diagram of the 4,620 h.p. GC-1 class of electric locomotive used on the New York–Washington express services of the Pennsylvania Railroad

effort 72,800 lb.; this latter value gives a factor of adhesion of 4·14 against the adhesion weight of 134 English tons, but the power of the locomotive is sufficient to maintain it up to 35 m.p.h. The total weight of the locomotive is 205 English tons and the overall length is 79 ft. 6 in. Each of the six driving axles has a twin-armature motor of 770 h.p. on the continuous rating. The gear ratio between the armature pinions and the gear wheel on the quill is 22:79. The quill bearings are of the split-sleeve type, but roller bearings are used for all the armature shafts, and also for all the driving and truck axleboxes on 51 of the locomotives. The motors are housed in welded frames which are carried on the locomotive main frame structure through three-point suspension. Two rolled steel cylinders form the main constituents of each motor frame, and to them are welded 124 smaller pieces. After welding, the whole frame is strain-relieved by heat treatment and is then machined. The normal operating voltage is 230-300 per armature or 460-600 per motor, with a maximum of 1,325, and the motors are connected permanently in three parallel circuits of four armatures per circuit. Each motor weighs 14,500 lb. Operating experience has shown that these locomotives will run about 250,000 miles between commutator turnings and over 100,000 miles between brush renewals.

The control system consists of a master controller which operates individual electro-pneumatic contactors tapping the secondary winding of the oil-immersed 4,800 kVA. transformer. There are 11 taps on the transformer secondary, allowing for 22 notches on the controller, and preventive coils are used to avoid short-circuiting a section of the secondary windings during tap changing. The number of notches in effect is trebled by the use of a notching transformer. Auxiliary apparatus includes two motor-driven blowers for cooling the traction motors; a 2·7 kW. d.c. generator to supply power for the control circuits, for lighting, and for charging the 300 amp. hr. storage battery, and a motor-driven compressor for the brake and control gear air.

A cast-steel frame is used as the bedplate for each half of the locomotive chassis, and these are articulated together at the centre by a ball and socket joint with a spring roller restraining device to prevent hunting on straight track. The cab and equipment compartments are built as a single structure of welded steel plates built up as a trussed bridge frame.

A 2,500 h.p. Pennsylvania freight locomotive of the L-6 class

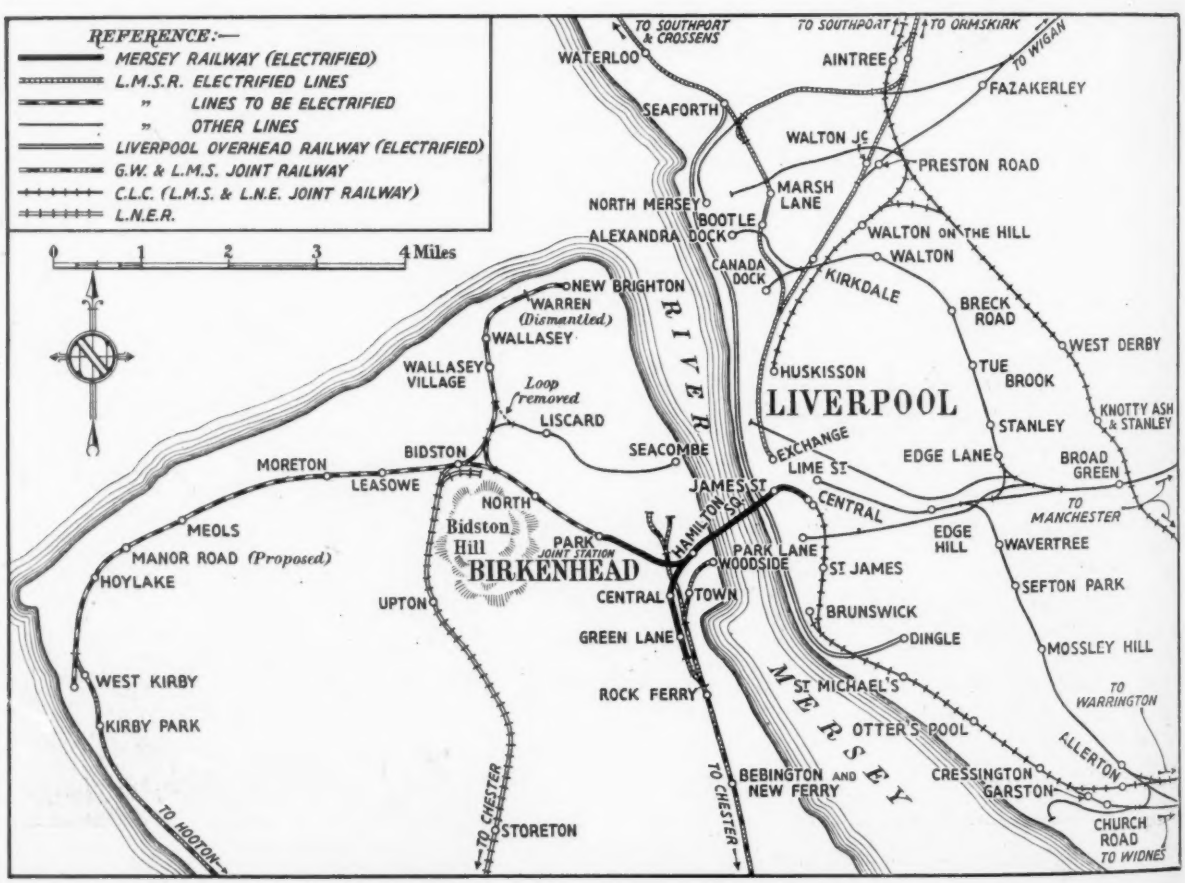
ALTERATION OF THE CONDUCTOR RAIL POSITION ON THE MERSEY RAILWAY

BETWEEN August 16 and September 9 the trains of the Mersey Railway were supplied with current by a method not previously used in this country. During this period they were temporarily fitted with double collecting shoes to enable them to pick up the current from either of two live rails fixed in different positions. The reason for this temporary abnormal method of working was that in order to adapt the railway for the through service of trains between the Mersey Railway and the Wirral section of the L.M.S.R. it was necessary to move the live rail from the position which was adopted when the railway was electrified, to the new standard position laid down by the Ministry of Transport.

The Mersey Railway was the first steam railway in this country to be electrified and as there was no precedent for the position of the live rail, it was arranged in the only one which would give sufficient clearance for the large and heavy steam locomotives which were in use during the period of electrification. In 1932 the Ministry of Transport fixed a standard position for all future electrification schemes, the standard being that adopted by the London Underground and the Southern Railways, which had the largest mileage in the country. So long as the Mersey Railway had no through running with other electric lines there was no necessity to bring the live rail into the

Illustration showing the two positions of the conductor rail; the crossover rail is in the new standard position and the conductor rail to the left in the old position

Below: Map of the Mersey Railway, showing its connections with the L.M.S.R.



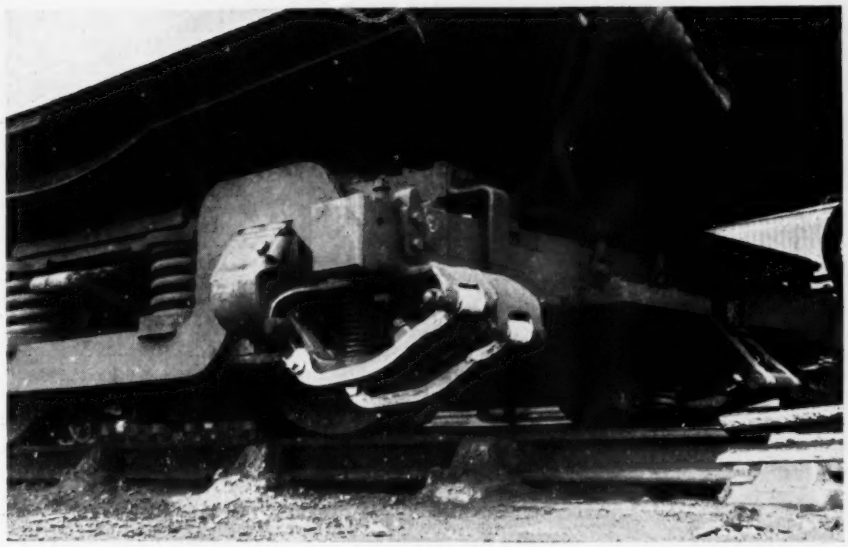


Illustration showing the double shoes fitted to the motor-coaches of the Mersey Railway to suit the two conductor rail positions used during change-over operations. The Mersey Railway normally uses four rails, viz., two running rails, a conductor rail, and a fourth rail for the return current

standard position, but as the Wirral section is being equipped to the standard position it was necessary for the Mersey Railway to adopt the same position.

The Mersey Railway position for the positive rail was 22 in. from the running rail and 5 in. above it, whereas the Ministry of Transport standard is 16 in. from the running rail and 3 in. above. It was necessary therefore to move the conductor rail 6 in. nearer to the running rail and lower it by 2 in. There were about 12 track miles of conductor rail, weighing approximately 1,000 tons, to be altered to the new position, and the problem of moving these rails without shutting down the railway presented some difficulties.

The first method considered was whether it would be practicable to effect the changeover by closing the railway for one Sunday and working through from midnight on Saturday to 5 a.m. on Monday. It was estimated that it would require 600 suitable men working in two shifts to carry out the operations. Even with this number of men, and it would have been difficult to put on a larger number, the prospect of having the line open for traffic on Monday morning was very doubtful. In this connection it was realised that it would be difficult to obtain such a large number of suitable men, and there was also the problem of finding a sufficient number of skilled supervisors.

The idea of equipping the trains with double shoes so that the work of moving the rails could be done gradually was then developed and after a number of experiments had been carried out it was considered that although it presented some difficulties it was the only scheme which could be adopted without closing down the railway for several days. Before the double shoe operation could be brought into use, a large amount of preparatory work was carried out over a period of some months.

On the night of Saturday, August 15, 80 men moved the conductor rails on all crossovers and at the junction at Hamilton Square. Until these were in the new standard position it was not possible for double-shoe working to commence; simultaneously each of the motor-coaches was equipped with four sets of double shoes. Owing to the amount of work to be got through on this night and the limited time available, a few electrical troubles were inevitable on the first day's operation. During the first week under the new working, in order to minimise the risk of electrical trouble, the speed of the trains was slightly reduced on some of the curves and this prevented the service being run with the usual degree of punctuality.

From August 15 to September 9, 60 men were engaged on the work of moving over the conductor rails and fixing them on new insulators. The period available for the work was from midnight to 5.0 a.m. on ordinary nights and from midnight to 8.0 a.m. on Saturday nights. In order to dispense with the number of double shoes in operation as quickly as possible, it was decided after the experience gained during the first week, when the rails on both tracks were moved simultaneously, to push on with the up line (*i.e.*, Birkenhead to Liverpool) so that the double shoes on one side of the trains could be discarded and the permanent shoes and their supports for the standard gauge could be fitted. The up line was completed on September 3 and was therefore worked with single shoes, the double shoes being retained for working the down line until the work was finally completed on September 9, since when the railway has been worked with single shoes to the new standard. The temporary shoe brackets used for supporting the double shoes are now being removed and the permanent brackets and shoes substituted.

CENTRAL ARGENTINE ANNIVERSARY.—On August 24 occurred the 20th anniversary of the opening of the Retiro—Tigre C section of the Central Argentine Railway's suburban electrification in the Buenos Aires district.

POLISH STATE RAILWAYS.—Trials of multiple-unit trains are being carried out on certain of the Warsaw suburban lines, the electrification of which by the Metropolitan-Vickers Electrical Co. Ltd. and the English Electric Co. Ltd. is nearing completion.

INDIAN ELECTRIFICATION.—The 16-mile double-track section of the B.B.C.I.R. from Borivli to Virar was opened to 1,500-volt d.c. electric traction in August by Sir Guthrie Russell, the Chief Commissioner of Railways. The electrification, which forms a prolongation of the existing electrified Bombay suburban system of the B.B.C.I.R. has cost Rs. 20 lakhs, inclusive of a mercury arc rectifier substation at Bassein Road. Power is obtained from Tata's 22-kV. three-phase supply. Proposals for the electrification of the main line between Mysore and Bangalore have been set aside for the present by the Mysore Government.

NOTES AND NEWS

New York Traffic.—The electric rapid transit railways of New York carry about 1,840,000,000 passengers a year (64 per cent. of the total traffic in New York) in 8,078 vehicles (60 per cent. of the total) over 886 track miles.

Safety by Electricity.—Ten years of electric suburban service on the Chicago system of the Illinois Central Railroad were completed on August 7. In this time 300,000,000 passengers have been carried without any fatal train accident.

Swedish West Coast Line.—The whole 185 miles from Malmo to Gothenburg will be opened to electric traction on October 1. The work of conversion has been proceeding for about two years, and various sections of the line at the south end have been operated electrically for some time past.

Austrian Electrification Loan.—A categorical denial has been given by the Austrian Federal Railways to the widespread rumours of negotiations with the American General Electric Company for a loan of £12,000,000 to carry out further railway electrification. The railway authorities said that any further electrification would be financed by means of internal loans.

Dutch Electrification.—Conversion work has begun near Maam, on the Arnheim-Utrecht section of the Netherlands Railways. Eventually the whole line, and other important routes in Holland, will be electrified on the Dutch standard 1,500 volts d.c. system, but work on the line near Maam is being pushed ahead in order to provide a test track for new rolling stock.

Electric Trains for Norway.—In connection with the electrification of the Oslo-Ski suburban line (see issue of this Supplement for October 18, 1935) the Norwegian State Railways have ordered from the Norwegian Brown Boveri Company four motor coaches of 640 h.p., which normally will be coupled to two trailers. It is expected that these cars will go into service at the end of the year, after brief trials on the Drammen line.

Paris Metro Cars.—Special light trailers are to be incorporated in the standard trains on lines 2 and 5 early next year in an endeavour to raise the speed of the trains while retaining the existing motor coaches. To obtain still further increase in the speed consideration is being given to the use of trains comprised wholly of motor-coaches, either of the present types, or in the form of articulated trains.

Central of Brazil Electrification.—The first batch of motor-coaches for the Central of Brazil Railway has been shipped from England by the Metropolitan-Vickers Electrical Co. Ltd. As the work of conversion is far advanced in the vicinity of Rio, it is hoped to start an electric service in January, 1937, between Rio (Dom Pedro II terminus) and Engenho de Dentro, a distance of about 7½ miles. When the suburban service is turned over to electric traction the long distance steam trains will be turned over temporarily from Dom Pedro II station to the Alfredo Maia station, what time a new wing is added to the former terminus.

South African Progress.—The Cato Ridge to Durban line in Natal will be opened to electric traction by the end of this year, and then it will be possible to run through by electrically-hauled train from Durban to Glencoe (245 miles) or from Durban to Harrismith (255 miles). Test trips have taken place already between Booth and Cavendish to test the current collection and the operation of the B.T.H. inverted rectifiers. One rectifier dealt satisfactorily with a load of 1,580 amp. 3,000 volts for over two minutes while two 1,000-ton trains were going uphill to Cavendish, and downhill regenerative loads up to 400 amp. were carried by the rectifier working inverted.

French Electrification.—The work of converting the Narbonne-Port Bou line of the P.O.-Midi Railway is proceeding. Four substations are being erected to feed the 64½ miles of double track, and special designs of pylons and catenaries are to be used in view of the high winds and salt-laden atmosphere in the district.

Resistance Grids.—Some trouble having been experienced through the cracking of cast iron resistance grids due to vibration, the Pennsylvania Railroad, after some research, has adopted a copper-nickel alloy, which, by reason of its high resistance (48 microhms per sq. cm. per cm.), permits of the size of the grids being reduced. Difficulty was experienced at first in the casting of this metal, but reliable grids are obtained by melting the nickel and copper in an electric furnace at a temperature of 1,350 to 1,400° C. and adding just before casting about 0·06 per cent. of silicium in order to de-gasify the mixture.

Railway Electrification Paper.—At a luncheon of the Manchester Rotary Club on September 3, Mr. C. H. Higgs, of the Metropolitan-Vickers Electrical Co. Ltd., described some of the advantages of railway electrification. He stressed the acceleration of schedules which was possible, not by higher maximum speeds, but by faster running uphill, a quicker recovery from slacks, and a higher acceleration from stops. Mr. Higgs dwelt also upon the reduction in operating costs and the more cleanly travel of electrified main-line railways.

Italian Electrification.—The 3,000-volt d.c. system between Tarvisio and Trieste has been extended to the frontier station of Postumia, and a saving in time of 30 min. in the journey from Trieste is to be made. Substations have been erected at Grignano, Opicina, San Pietro, and Postumia. The electrical equipment on the San Pietro del Carso to Fiume line has been installed and electric traction will begin in October. On this line there is one substation only, at Abbazia Mattuglia. Power for both lines is being obtained from hydro-electric stations in the Julian Alps. Automatic block signalling has been installed on the Trieste–Postumia line, where top speeds of 62 m.p.h. are reached regularly by the electrically-hauled trains.

Subway Proposal for Rio.—A short time ago tenders were invited for the construction of an underground railway in Rio de Janeiro, but no offers were received. The city authorities now are considering the offer of a group of American financiers to loan a sum of 900,000 contos (about £10,000,000) for this purpose, subject to satisfactory guarantees. An alternative proposal for obtaining the money locally has been put forward also. This seeks to utilise part of the excess money which would be obtained by the Light & Power Company (which operates the Rio tramways) if that organisation's request for increased tram fares was granted, for the smallest coin being 100 reis, an increase of this amount would bring in an amount deemed to be above the Light & Power Company's needs. It is thought that by giving one quarter of the increase to the company and the remaining three-quarters to the municipality, a sum of 42,000 contos a year would be available. The main station of the proposed underground would be in the centre of the city near the Morro do Castello and lines would radiate therefrom to the suburbs of Cascadura, and Copacabana.